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NEW YORK, NEW JERSEY PORT AND HARBOR DEVELOPMENT COMMISSION

JOINT REPORT

WITH

COMPREHENSIVE PLAN AND RECOMMENDATIONS

1920

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JOINT REPORT WITH COMPREHENSIVE PLAN AND RECOMMENDATIONS

New York, New Jersey Port and Harbor Development Commission

Appointed Under Chapter 426, Laws of 1917, State of New York
Appointed Under Chapter 130, Laws of 1917, State of New Jersey

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Benham, Indiana; V. M. Brennan, Michigan; L. W. Fairchild, Indiana; R. G. FitzGerald, Ohio; Manuel Herrick, Oklahoma; Even J. Jones, Pennsylvania; S. A. Kendall, Pennsylvania; J. C. Linthicum, Maryland; W. Turner Logan, South Carolina; M. C. McLoughlin, Nebraska; Merril Moores, Indiana; A. N. Peterson, New York; Albert D. Rossdall, New York; Peter G. Ten Eyck, New York; Lester D. Volk, New York; F. N. Zihlmann, Maryland; W. W. Chalmers, Ohio; J. B. McClintic, Oklahoma; John M. Rose, Pennsylvania; Milton W. Shreve, Pennsylvania; Frank H. Funk, Illinois; Charles G. Bond, New York; S. Wallace Dempsey, New York; H. M. Jacoway, Arkansas; Ross A. Collins, Mississippi; James J. Connolly, Pennsylvania; Nathan I. Strong, Pennsylvania; Amos A. Radcliff, New Jersey; Henry Z. Osborne, California; M. A. Michaelson, Illinois; Carroll L. Beedie, Missouri; Joseph H. McGann, Clerk on Committee Rivers and Harbors; William E. Kenney, Clerk of House; J. A. B. McElveney, Secretary to Congressman Ten Eyck; John Carew, Ways and Means Committee; Thomas Sisson, Mississippi, Appropriations Committee.

ADVISORY COUNCIL NAMED BY PORT AUTHORITY

The Port Authority of New York during the Summer made public a tentative list of the members comprising the Advisory Council, consisting of representatives of commercial organizations from all over the Port District. The following are the names:

The Chamber of Commerce of the State of New York is represented on the Council by President Kingsley, Marcus H. Tracy, and David T. Warden.

Litchfield F. Moynahn, Bay Ridge Chamber of Commerce; A. W. Coffin, Hoboken Chamber of Commerce; Frank F. Boulton, president Maritime Association, Port of New York; A. D. Way, Motor Truck Club of New Jersey; H. C. Long, Downtown League; William E. Taylor, Jersey City Chamber of Commerce; James Madden, North Jersey Automobile Club; Myron W. Robinson, Hackensack Women's Club; Alexander Haring, Bronx Board of Trade; B. Levyn, J. D. Homes, New England Society of Orange; J. D. Holmes, Merchants' Association; Frank Munson, American Steamship Owners' Association; Edward P Kanyen, Tarrytown Merchants' Association; Edward W. Powest, Forty-second Street Property Owners' & Merchants' Association, Inc.

Louis Stern, Forty-second Street Association; Ernest Storey, New York Boat Owners' Association; William H. Douglas, West End Association; Mayo Fesler, Brooklyn Chamber of Commerce; H. Hatcher, Hoboken Chamber of Commerce; F. B. DeBerard, Merchants' Association; John McAuliffe, Jr., New York Produce Excange; N. B. Killmer, New York Harbor Protective and Development Association; William J. Pedrick, Jr., Fifth Avenue Association, Inc.; W. Eugene Furton, Associated Automobile Clubs of New Jersey; Robert H. H. Koehler, Fifth Avenue Association, Inc.; J. H. Holet, Todd, Robertson, Todd Engraving Corporation; J. Ernest Crane, Newark Public School Principals' Association.

Henry Moscowitz, Newark Traffic Club; Alexander Stolz, Yonkers Water Front Commission; H. John Ward, New York Harbor Development and Protective Association; Wesley H. Ryan, secretary King's Highway Board of Trade; Borden H. Harris, Bronx Board of Trade; George P. Hernstreet, Westchester County Chamber of Commerce; L. Victor Werl, United Real Estate Owners; F. R. Howe, Chamber of Commerce, Borough of Queens; Mrs. F. C. Hodgdon, Woman's Municipal League; Augustus Smith, Chamber of Commerce, Bayonne; W. B. Gibbs, Thirty-fourth Street Board of Trade; Mrs. Tolen Blair, Women's City Club; Vivian Green, Thirty-fourth Street Board of Trade; C. F. Haggerty, Dock Department; H. B. Walker, Merchants' Association.

R. W. Creuzbaur, Bay Ridge Chamber of Commerce; Mrs. W. E. Kruesi, Women's City Club; Cornelius C. Kolff, Hugo W. Behrend, Staten Island Chamber of Commerce; Rutherford H. Walker, North Hudson Realty Board; Walter I. Willis, secretary Queens Borough Chamber of Commerce; Charles I. Austin, New York Produce Exchange; Edward S. Walsh, New York Board of Trade.

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to use freight in small quantities are packet boats which will make scheduled trips, stopping regularly at points along the way.

Congressman Dempsey and others frequently brought out the point that barges returning from New York must carry a full load of freight. The Brooklyn Terminal will help to do this because small quantities of goods can be brought together to fill the barge to its capacity. It was shown that a boat load of bricks can be brought to New York City by the canal and sold $2 a thousand less than when brought by railroad. In the matter of lumber, steel rails, pig iron and other products of bulk, the saving in cost of transportation was very materially lessened over rail rates.

Among those present on the canal trip were the following:

A. M. O'Neill, Assistant Deputy Superintendent of Public Works, Albany; John O'Connor, Department of Public Works, Albany; Edmund Platt, Vice-President of the Federal Reserve Board, Poughkeepsie; S. A. Payer, Traffic Manager, Chicago Bridge and Iron Works; Frank J. Rahe, Indiana Chamber of Commerce, Fort Wayne, Ind.; R. P. Sturtevant, F. R. Lindsay, Department of Public Works, Albany; C. E. Sherman, Ohio Chamber of Commerce, Columbus, O.; C. T. Strip, Traffic Manager, National Malleable Casting Company, Cleveland, O.; Ira J. Strong, Saugerties Chamber of Commerce; Cornelius C. Kolff, Staten Island Chamber of Commerce; Archibald Sexius, *New York Tribune;* Paul Sexton, Syracuse Chamber of Commerce; M. M. Tweling, Traffic Manager, Willard Storage Battery Company, Cleveland, O.; George A. White, Albany Chamber of Commerce; A. M. Voorhis, Nyack Chamber of Commerce; W. T Wightman, Traffic Manager, Brown Hoisting Machinery Company, Cleveland, O.; Edward S. Walsh, General Manager, New York Canal and Great Lakes Corporation, New York; W J. Walker, Peekskill Chamber of Commerce; Lachlan MacLeay, Pyro-Non Paint Company, Brooklyn; George W. Smith, Lackawanna Steel Corporation, Buffalo; Martin J. Lower, Traffic Manager, International Harvester Company, Auburn; William O. Dapping, Auburn Chamber of Commerce; Earl E. Bockstedt, Traffic Manager, Columbia Rope Company, Auburn; Waldo C. Morse, Citizens' Club, Seneca Falls; A. D. Fairbairn, journalist, Washington; A. R. McKim, Albany Chamber of Commerce; R. S. Barrett, Catskill Chamber of Commerce; J. B. Wallace, *Record,* Troy; L. I. Walsh, journalist, Ridgewood, N. J.; N. L. Webster, New York; W. W. Seymour, Syracuse; N. W. Micholson, Commissioner of Public Safety, Syracuse; Robert J. Arnold, *The Knickerbocker Press,* Albany; G. Snedeker, reporter, Amsterdam; Bernard McCabe, stenographer, New York; S. Katz, reporter, New York; A. V. S. Olcott, Captain R. Magee, J. R. McDonough, C. J. Taylor, Hudson River Day Line; William Belknap, Oscawana; Miss H. Schoenfield, New York; M. S. Thompson, Hudson; S. A. Thompson, Washington; S. M. Van Dusen, Hudson; Oscar Bedere, Chief Engineer, Hudson River Day Line; James R. Bibbins, H. J. Adamson, *New York Evening Post,* New York.

The following are included in the official list of delegates:

Frank H. Bear, Traffic Commissioner, Cleveland Chamber of Commerce; Herbert H. Gunnison, *Brooklyn Daily Eagle;* Robert Boettger, Yonkers Chamber of Commerce; S. Bullock, Inland Marine Corps; S. A. Breese, Export Traffic Manager, International Harvester Company, New York; Charles L. Cadle, State Superintendent of Public Works, Albany; Henry Castor, Department of Public Works, Albany; Thomas J. Comerford, *Kingston Leader;* A. B. Chase, Hudson Chamber of Commerce; H. P. Childs, General Electric Company, Orange, N. J.; Lewis S. Coe, Stamford Chamber of Commerce; W. D. Dodge, Department of Public Works, Albany; W. J. Dibble, Traffic Manager, Hudson Motor Car Company, Detroit, Mich.; John D. Dunlop, Nyack Chamber of Commerce; W. W. Donnelly, L. S. Docherty, Hudson Chamber of Commerce; Fred B. DeBerard, Merchants' Association of New York; W. J. Dobbin, journalist, New York; M. W. Eisman, Traffic Manager, Manufacturers' Association, Erie, Pa.; E. W. Murphy, Auxiliary of American Specialty Manufacturers, New York; D. M. Finger, Saugerties Chamber of Commerce; Senator L. W. H. Gibbs, Chairman of the New York State Commission to Oppose the St. Lawrence River Canal; Marshall S. Graham, Traffic Manager of the Reo Motor Car Company, Lansing, Mich.; Charles T. Gwynne, Secretary of the State of New York Chamber of Commerce, New York; G. P. Graham, Albany Chamber of Commerce; A. E. Harrell, New York; Elias L. Howland, *Journal of Commerce,* New York; Murray L. Hulbert, Dock Commissioner, New York; E. E. Hodges, Traffic Manager of the Hupmobile Motor Car Company, Detroit, Mich.; W. B. Holland, *New York World;* Allan B. Jordan, Vice-President of the Great Lakes and Ohio River Waterways Association, Columbus, O.; James C. Lincoln, Merchants' Association, Albany; E. F. Metcalf, President of the Auburn Chamber of Commerce; J. L. Martin, Dr. Henry Moskowitz, Submarine Boat Corporation, Newark, N. J.; George E. McCoy, President of the Hudson Valley Federated Chambers of Commerce, Peekskill; J. J. MacClurkan, Submarine Boat Corporation, Newark, N. J.; A. G. Moore, Department of Public Works, Albany; Dr. Edgar S. Barney, Secretary and General Passenger Agent, Hudson River Day Line.

Representatives: Frederick C. Hicks, New York; E. S. Brooks, Illinois; John S.

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INSPECTION OF NEW YORK PORT

On August 23, members of Congress and the legislators of New York and New Jersey, together with a number of State officials, army engineers, and other guests, made a tour of inspection through the new Port of New York District under the escort of the Port Authority and the chief engineer of that body. The trip started from the foot of West Forty-second Street, Manhattan, where a party of two hundred boarded the steamer "Visitor." Assistant Secretary Tamblyn represented the New York Chamber. In the reports of the trip published in the newspapers following the trip was the following data on the Port:

The new Port of New York District takes in 105 municipalities, large and small, in the States of New York and New Jersey.

Besides Greater New York and part of Westchester, Rockland and Nassau Counties of New York, it takes in the following counties of New Jersey: Union, Hudson, Passaic, Essex, Middlesex, Salem, Bergen, Somerset and Monmouth.

The Port District includes in New York State, the City of New York (boroughs of Manhattan and the Bronx), Yonkers, Hastings, Dobbs Ferry, Irvington, Tarrytown, Ardsley, Bronxville, Mount Vernon, Tuckahoe, Scarsdale, New Rochelle, Larchmont, Pelham, Pelham Manor, Piermont, Palisades, Mamaroneck, Harrison, Rye, and Portchester. On Long Island the boundary line of the Port District passes through Manhasset, Port Washington and New Hyde Park.

There are 8,000,000 inhabitants in the Port District.

The New York District outranks any other metropolitan district in the Western Hemisphere by nearly 200 per cent. Within the district are located more manufacturing industries than in the four cities of Philadelphia, Chicago, Cleveland and St. Louis combined.

The straight waterfront within the Port of New York, measured along the shore line, aggregates 771 miles, of which 578 are in New York and 193 in New Jersey. Measuring around the piers and shore line gives 991 miles, of which 751 are in New York and 240 are in New Jersey.

In New York City there are 709 piers, twenty-four of which are owned by the United States Government, seven by the State of New York, 267½ by the City of New York and 410½ privately. The entire area of the Port of New York com-

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prises 175 square miles. Within this vast area any half-dozen of the leading other ports of the world could be placed and a large area still left uncovered.

The shipping engaged in foreign trade entering the Port of New York during the year ending June 30, 1920, totaled 17,404,000 tons, and clearances of vessels in foreign trade totaled 16,045,000 tons. The value of the foreign commerce of the Port of New York during the year ending June 30, 1920, was $6,309,358,037, of which $2,904,844,143 constituted imports, exports being valued at $3,404,513,894, and the foreign commerce of the Port of New York constituted 47 per cent. of the foreign commerce of the whole United States. So great are the fluctuations, that the value of our foreign commerce was nearly $2,000,000,000 greater in 1920 than in 1919, while in the year ending June 30, 1921, the drop from 1920 was nearly $2,000,000,000 —the actual figures being: Value of imports, $1,927,692,608, and of exports, $2,513,728,875.

PORT OF NEW YORK LAW SIGNED BY PRESIDENT HARDING AUGUST 23rd

On August 23rd, President Harding signed the Edge-Ansorge joint resolution giving Federal authority for development of the New York Port along lines proposed by the New York-New Jersey Port Development Commission in the treaty entered into by the two States on April 30, 1921.

Representative Martin C. Ansorge, of New York, was sponsor of the resolution in the House. The signing of this resolution marked the culmination of the most far-reaching step ever taken for the development of the greatest natural port in the world.

The War Department, in a letter signed by Secretary Weeks, in recommending the passage of the Edge-Ansorge resolution, said: "The adequate improvement and development of port facilities of New York is a deserving enterprise and if the work is accomplished on the comprehensive plan of co-operation contemplated by the two States it will doubtless result in benefit to the transportation interests of the entire nation."

NEW YORK HOSPITAL 150 YEARS OLD

The New York Hospital celebrated the 150th anniversary on October 26th. President Kingsley represented the Chamber at the ceremonies.

THE ST. LAWRENCE CANAL

Secretary Gwynne attended the meeting at Albany on September 1st, called by the Hudson Valley Federated Chamber of Commerce, to formulate plans to oppose the canalization of the St. Lawrence River.

The Hon. Murray Hulbert, Commissioner of Docks, was among the speakers at the meeting. The Commissioner is quoted by the Albany *Press* to have said:

> "The people of the State of New York, realizing it was the Erie Canal that made the City of New York the metropolis, and realizing its perpetuation depended upon the canalization of its existing waterways, went into their own pockets and contributed something in excess of $160,000,000

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PART FOUR

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PART I

Summary of Joint Report with Comprehensive Plan and Recommendations

New York, *December* 16, 1920.

To the Governor of the State of New York; to the Governor of the State of New Jersey:

Sirs.— A serious situation confronts the Port of New York. The Port has drawn to itself a tremendous volume of business — nearly half of the foreign commerce of the country; more industrial establishments than are found in any other three metropolitan districts in the United States; more than twice as many inhabitants as reside in any one of those three. Continuous streams in and out of goods of all kinds are required to carry on the business of the Port and to sustain the life and health of its inhabitants. So large have become these streams, so little reservoir space is available in certain parts of the Port, that extraordinary mechanisms are required to make them flow with the necessary volume and smoothness. These mechanisms are the terminal facilities of the district — railroad lines, railroad stations, piers, ferries, tugboats, lighters, motor trucks, warehouses, markets and other facilities.

The Port has indeed gone to unmatched lengths in providing many of these facilities. But it has not kept pace with the demands and there has never been any general comprehensive plan for terminal developments of the Port considered as a whole to which all parties interested have subscribed or toward the realization of which all, municipal and private, have co-operated. In consequence the flow of goods has become more and more irregular, terminal costs have mounted and the burden of congestion and expense presents a situation needing immediate correction. Other ports are capitalizing these facts and are threatening — not to take away New York's trade, for it is too well fortified with natural advantages for that, but to absorb the increase of the country's trade which is bound to come as the country continues to grow, and to draw new industries because of the alleged lower costs of doing business at those ports.

This is not merely a problem for the concern of public officials, directors of railroads, steamship companies and other terminal enterprises. It is a great sociological problem of chief concern to the public at large. A heavy burden is thrown upon the commerce of the Port and adds to the cost of living. The public feels the oppressiveness of this burden but is unable to analyze its causes, which, however, can and should be removed.

Some eight million persons live within twenty-five miles of the Statue of Liberty in New York Harbor. All must have food, and all help to pay the millions of dollars wasted annually through inadequate market facilities, lack of economical means of local transportation of foodstuffs, and the resultant excessive handling, excessive trucking, excessive exposure to the elements. All wear clothing, and all share in the high expense of delivering either finished products received from elsewhere or raw materials used here in manufacturing. Housing is an acute problem, and the inadequacy of terminal facilities for handling building materials discourages new construction. Every bucket of coal must come through these terminals. Hardly a commodity for sale but bears some burden of high terminal costs.

It is not alone a matter of costs. Several times since this Commission was created, marine or other strikes have cut off the inflow of foodstuffs and threatened serious hardship throughout the metropolitan district.

Under existing conditions the weather, too, plays its part. Coal is frozen in cars in the New Jersey yards, and ice jams in the harbor waters deter the movement of coal barges, so that with an abundance of coal within the district rapid-transit and lighting companies have been threatened with shutdowns for lack of fuel.

Hardly less direct in its application to the general public is the effect of inadequate terminal facilities on the merchants and manufacturers of the district. These merchants and manufacturers employ heads of families by the hundreds of thousands. If their costs of receiving and delivering goods are excessive, or if repeatedly they suffer heavy damages through inability of the terminal facilities to handle their goods promptly and properly, their ability to pay their employees adequately is lessened. Shrinking margins of profit may force employers out of business, or more favorable opportunities for doing business elsewhere may impel them to leave the port district. In either event the local employees suffer.

Besides the eight million inhabitants within the metropolitan district there are about six millions in New York or New Jersey beyond the limits of the district. These six millions do not escape the burden of inadequate terminals at the Port of New York. The Port is a primary distributing center. Certain goods reach Buffalo and Atlantic City via New York, and New York's prices determine the prices at Buffalo and Atlantic City. Again, terminal costs and conditions at the Port of New York determine whether the producer of western New York or interior New Jersey can compete for export trade with producers in other States shipping through other ports.

Finally, the problem of the Port of New York has, too, a national aspect. Traders the world over have selected New York as the principal gateway between the United States and the world at large. New York is, for example, a terminus for nearly all of the most important transatlantic lines. To force them to other ports, if it could be accomplished, would cause a disorganization of their business, the cost of which the public would inevitably pay. Reduced costs of operation at the Port would help the farmers of the country in shipping grain through the Port. Yet New York suffers from discrimination in railroad rates, and powerful influences other than those of rival ports have been exerted to divert its business. The effort should rather be to stabilize that business and make trading through this established gateway as attractive as possible to all those whose contact with the United States is chiefly through that gateway.

The Commission has been deeply concerned with the sociological as well as the commercial aspects of the port problem. It has felt it to be as great an obligation upon the two States most immediately involved to accomplish a solution that will bring relief to the people as it was to find the statistical, engineering and physical factors that would make this relief possible.

Comprehensive Physical Plan

Our port problem is primarily a railroad problem. Navigable water, or water easily made navigable, reaches into nearly every part of the Port District, while rail accessibility and co-ordination therewith are lacking at many points. Therefore the comprehensive plan to evolve which this Commission was created is essentially a railroad plan. With the proper network of rail facilities, the development of other terminal facilities can follow along rational lines, and the Commission needs only suggest forms which that development can take.

A complete reorganization of the railroad terminal system is the most fundamental physical need of the Port of New York. Such a reorganization will involve new methods of handling freight from the break-up yards of the railroads. The plan recommended calls for improving and opening up for joint use the existing belt-line links in New Jersey and constructing other belt lines along navigable New Jersey waters and farther inland; building similar marginal railroads along navigable waters adjacent to Brooklyn, Queens, Staten Island and the Bronx and utilizing with them the Long Island Railroad and the New York Connecting Railroad to form a belt-line system in New York; connecting the New Jersey and New York belt systems, at first by car ferry and ultimately by tunnel under the Upper Bay; operating all of these lines jointly and operating jointly, through new joint railhead terminals, all railroad marine service not replaced by other service; and building an underground railroad system carrying special electrically operated cars, connecting with all of the railroads of the Port, serving virtually all of Manhattan and enabling the railroads to discontinue their pier stations and release the waterfront to other uses.

This remodelled terminal railroad system, bringing every railroad of the Port to every part of the Port, and thus giving every part of the Port opportunity to develop and to have the economical transportation service needed for its commercial and industrial growth and expansion, constitutes the comprehensive plan of the Commission — the plan which the Commission recommends for formal adoption by the two States. There is submitted with this report a map (Fig. 1, Part IV) showing an " Outline Summary of the Comprehensive Plan for the Future Development of the Port."

This plan aims to provide for the development of the Port both for the immediate future and for many years to come. Future study will be required to determine the economic sequence of construction. Certain parts of the system, however, as set forth later, should be constructed at once.

Collateral Port Improvements

With such a system in operation, and only with such a system, other far-reaching changes recommended by the Commission can be made effective. One of these is a reorganization of the principal waterfronts of the Port, with a view to giving each class of water traffic better access to the waterfronts best suited to it; to providing better designed piers and better co-ordination of the different facilities — railroads, trucks, lighters and warehouses — involved in the handling of goods to and from ships; and in general to reducing the time and cost of transferring cargo. Another, and one of the most direct concern to the 8,000,000 inhabitants of the Port District, is the improvement of the existing methods of food distribution, through the establishing of food receiving stations away from the congested primary market district. The plan recommended, the Commission is confident, will reduce the congestion, delays, rehandling, excessive trucking and unwarranted expense of the present system, and incidentally make for fresher food, must come through these terminals. Hardly a commodity for sale but bears some burden of high terminal costs.

It is not alone a matter of costs. Several times since this Commission was created, marine or other strikes have cut off the inflow of foodstuffs and threatened serious hardship throughout the metropolitan district.

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These and other collateral port improvements are urged by the Commission. They require further study by the proposed port authority, however, and are not recommended as part of the comprehensive plan.

Administrative Plan

An administrative change equally far-reaching was recommended by the Commission in its Progress Report of April 8, 1919, which urged the creation by agreement between the two States of a Port Authority with jurisdiction over the entire Port District, so constituted as to enable it to carry out a continuing policy.

Additional reasons for such a Port Authority are brought out elsewhere in this report. The Commission mentions one at this point, a potent one. Such an authority is necessary to make successful the Commission's plan, or indeed any other plan, for giving every inhabitant of the Port fresher food at a lower price, through food receiving stations with a public inspection service at the railroad yards, and the opportunity for direct delivery from those yards. But it will be obvious from further reading of the report that no comprehensive plan can be worked out unless the Port District is treated as a whole.

History and Purpose of Investigation

This Commission was created in 1917 by the concurrent action of the Legislatures of New York and New Jersey to study the problem of the Port as a whole and recommend a policy to be pursued for the best interest of the entire Port. It was created while the New York and New Jersey sides of the Port were still arrayed against each other in the New York Harbor Case, a dispute over alleged discriminatory rates and practices between the two sides of the Port, and its creation represented a realization that the best interests of all would be served by co-operation instead of litigation.

With one exception the present members of the Commission, as indicated by the signatures to this report, were the original appointees. Arthur Curtiss James resigned December 31, 1918, owing to his intended absence in Europe in connection with the work of the American Committee for Relief in the Near East. The Commission gratefully acknowledges Mr. James's helpful activities during his term of service. Murray Hulbert, Commissioner of Docks of the City of New York, was appointed to succeed him.

Pursuant to the legislative enactments, the Commission has divided its work into two principal parts — the preparation of a physical plan and the development of a method of administering that plan. The physical investigation has followed three fundamental lines: (1) Study of existing conditions, (2) analysis of the handling of freight under existing conditions, and its costs, and (3) designing of new methods and facilities, based upon their economic justification as to their most important features.

Only the most salient features of the physical investigation, to which a large engineering corps devoted two years, can be presented in this summary, the details being left to other parts of the report.

The Port Problem

There is no counterpart of New York's port problem in this country or in the world. In population the New York district outranks any other metropolitan district in the western hemisphere by nearly 200 per cent. Of the foreign commerce of the United States, substantially one-half passes through the Port. Within the District are located more manufacturing industries than in the four cities of Philadelphia, Chicago, Cleveland and St. Louis combined.

New York is furthermore the financial center of the continent. It is the distributing point for foodstuffs for a large area, and its prices have a large effect on prices throughout the country. It is the commercial and industrial capital of the United States, and as such is the seat of many important activities not found anywhere else in the country.

In 1914, the latest year not materially affected by the world war, the Commission has found that 76,000,000 tons of freight moved into, out of or through the Port District by rail. The Commission estimates that in the same year 45,000,000 tons moved into, out of or through the Port by water, irrespective of a possibly greater tonnage moved locally within the District by water.

Nearly 100,000,000 bushels of grain are exported from New York annually. More than 38,000,000 tons of fuel and ore, mostly coal, entered the District by rail in 1914, some to be loaded upon barges and towed to New England points, some to be turned into the bunkers of ships, much to be consumed within the District. More than 4,000,000 tons of foodstuffs other than grain and mill products were brought to the Port during the same year by rail only, besides a large amount brought by water, and a large percentage of this was perishable food which had to be delivered to the consumer within a comparatively short space of time.

The foregoing indicates roughly the magnitude of the transportation operations of the Port. And what are the facilities for conducting these operations? They can perhaps best be considered under three main headings — the geography of the Port and the present operations of the two principal agencies of transportation, the railroad and the steamship.

Geography of the Port

Both physically and politically there are conditions which tend to make terminal operations and the rational development of the Port very difficult.

PHYSICAL GEOGRAPHY

Physically we find a territory very much cut up by waterways — which give the District a magnificent waterfront of some 800 miles and an inner water belt line, but also mpose great obstacles to land transportation, as do the hills and ridges on the land sections iof the District.

In about the center of the District we find the greatest concentration of population, commerce and industry in the United States. This is on the island of Manhattan — a narrow strip of land separated from any other land at the south by the expanse of the Upper New York Bay; from the New Jersey mainland on the west by the mile-wide Hudson River, with no physical connection except three tunnels carrying railroad passengers only; from Long Island on the east by the East River, across which there is also only such physical connection as can be afforded by four highway and rapid-transit bridges, a railroad bridge and five railroad passenger tunnels. Only at the north, residential end of the island, across the Harlem River, is what may be regarded as easy access to the mainland, and this mainland itself is a rugged promontory divided from the land to the west of it for some 150 miles by the Hudson River.

East of Manhattan we find Long Island, the western end of which is highly developed, with 2,500,000 inhabitants and a large number of commercial and industrial establishments, but no physical connection with any other land except by the tunnels and bridges to Manhattan previously mentioned. On the south is Staten Island, with an area of more than double that of Manhattan, but also isolated from other land except for one railroad bridge across the Arthur Kill, and largely undeveloped because of this isolation. On the west is the fourth great division of the Port, the New Jersey division, which consists of a succession of ridges and valleys, beginning at the very water's edge, that make for difficult land transportation.

POLITICAL GEOGRAPHY

Through the Hudson River and the Upper Bay runs the State line between New York and New Jersey. Eight of the twelve railroads on which Manhattan, Brooklyn, Queens and the Bronx depend are on the New Jersey side of the Hudson, with only pier and float-bridge stations for handling the freight of these roads on the New York side. A ninth road, running into Staten Island, is in the same category, as Staten Island is more widely separated from Manhattan than is New Jersey.

Until 1898 different parts of the present New York City were under separate governments, and even today there is a diversity of opinion as to the course the development of the New York side of the Port should take. Yonkers and other communities to the north along the Hudson, and New Rochelle and other communities along Long Island Sound, deemed by the Commission to be within the Port District, are under separate governments.

On the New Jersey side of the river the political subdivision is still more extensive. Here are more than forty municipalities, from Newark, a city of nearly half a million inhabitants, to small boroughs and townships. Quite divergent points of view are found in the different communities.

Jersey City and Hoboken grew up along the Hudson around railroads that had already come to serve New York, and both found that the greater part of their Hudson River waterfront had been acquired by the railroad and steamship companies before the cities had reached a state of development where its value was appreciated. Jersey City has recently taken steps to remedy the situation somewhat by developing the west waterfront. Newark, an older city more remote from most of the railroad yards and terminals, has not suffered to the same extent the loss to private control of the lands best suited to its own water-terminal needs, and has been developing a plan having as its objective the establishment of itself as an independent seaport. Bayonne, Elizabeth, Perth Amboy, Paterson, Passaic and other communities are each interested in the Port's development from different angles.

To have guided the growth of transportation and terminal developments in earlier days would have been difficult enough for a single authority with jurisdiction over the entire port. It was impossible with the Port divided within itself.

The joining of many of these communities in the New York Harbor Case was probably the first sign of realization on their part of common interest in the port problem. The fact that the State of New Jersey, more than 60 per cent of whose inhabitants live within the suggested Port District, joined with the State of New York in the plan to co-operate in this investigation testifies still more forcibly to the unity of interest in the problem as a whole.

Present Railroad Operations

Twelve railroads, exclusive of purely local enterprises, come to the Port of New York. Nine of these enter the district from New Jersey, have their railheads in New Jersey or Staten Island, and are referred to as the New Jersey railroads. The remaining three enter from New York, terminate in New York and are referred to as the New York railroads.

Of the 76,052,000 tons of freight moved into, out of or through the Port District in 1914 by the railroads, 53,359,000 tons were brought in by rail and delivered within the district for local use or removal by water or truck, 9,756,000 tons were despatched by rail from points in the district, and 12,937,000 tons were brought in by one railroad, delivered to another and so carried through the district by rail. In terms of freight cars of the average loading found within the Port, this tonnage would have required more than 3,000,000 cars or 25,000 miles of cars — enough to encircle the earth.

COMMODITY TONNAGES

Of the 53,359,000 tons of freight referred to in the preceding paragraph, 34,345,000 tons were fuel and ore. There were in round numbers 4,000,000 tons each of grain and mill products, of other foodstuffs and of building materials. The remaining 6,747,000 tons were classified as miscellaneous. While nearly all of the fuel and ore tonnage was distributed locally by lighter, the car float was a potent factor in the handling of miscellaneous freight and of foodstuffs other than grain, handling 49 per cent and 42 per cent respectively of the total tonnage of those commodities.

The first necessity of the Port District is its daily food supply. Following this closely in importance is the supply of manufactured necessities, such as clothing and furniture, and of raw materials from which it can produce these and other necessities and luxuries, both to supply its own population and to keep goods moving in the channels of trade. In short, the ability of New York to function as a great port depends first of all on its ability to feed and clothe its own population and to provide its merchants and manufacturers with the transportation they require to do business successfully. Until it serves itself it cannot adequately serve others.

MANHATTAN PIER STATIONS

Within the two categories of other foodstuffs and miscellaneous freight come most of the commodities above referred to. These are the commodity groups in which the car float plays such an important part, and they are concentrated largely on the island of Manhattan. To handle them there has grown up an extensive system of pier and inland rail stations along the lower Hudson and East River waterfronts in Manhattan. The stations are expensive to operate and occupy waterfront in great demand for more appropriate uses. The Commission early perceived that these stations must be the starting point for its comprehensive plan. They must be greatly improved or preferably be replaced by a system that would release part or all of the waterfront they occupy.

The amount of freight a substitute system would have been called upon to handle in 1914 was 4,465,083 tons inbound and 2,783,354 tons outbound — a total of 7,248,437 tons. Figures assembled for the stations in question for fifteen consecutive years, 1905 to 1919 inclusive, show an upward trend averaging about 2 per cent per year. The Commission estimates therefore that a substitute system would have to accommodate 9,000,000 tons of freight in 1924 and 10,000,000 tons in 1929.

RAILROAD OPERATING COSTS

Freight brought to the Port by rail is, with a few exceptions, delivered without terminal charge to any point accessible to cars or lighters within lighterage limits circumscribing virtually all of the intensively developed waterfront. Similarly the railroad collects freight from such points without extra charge. The railroad in each instance absorbs the entire terminal expense, or in the case of shipments moving over two or more connecting lines the railroads involved share the expense of "free" terminal service by making from the total rate an allowance to the railroad providing the terminal service of a sum intended to cover that service. The present allowance ranges from 60 to 80 cents per ton.

It is well known that the allowance falls far short of paying for the service. The Commission's analysis, which it believes to be more accurate than any previously attempted by any agency, gives the following figures for operating costs in 1914: For goods handled at Manhattan car-float pier stations or inland rail stations, $1.60 per ton; for goods handled at Brooklyn, Harlem or Bronx stations, $1.48 per ton; for goods lightered, $2.14 per ton.

These figures cover only the cost to the carrier. To arrive at the full cost of handling the freight within the Port District there should be added substantial sums for trucking and handling by local shipper or consignee between his plant and the railroad station or other point of delivery or receipt by the railroad.

On the basis of 1918 prices, which are obviously much higher than those of 1914, the Commission estimates that the total terminal costs to the railroads were about $2.25 per ton for freight handled to or from Manhattan stations, $2.08 for that handled to or from Brooklyn, Harlem or Bronx stations and $3.01 for freight lightered.

Considering the tonnage at the Manhattan stations alone, which amounted in round numbers in 1918 to 8,500,000 tons, the cost of the terminal operations at $2.25 per ton was about $19,125,000. Assuming an average terminal allowance for this freight of 75 cents per ton, the total allowance would be $6,375,000 and the deficiency of the terminal charge in the single year on the one class of freight would be $12,750,000 — the interest at 5 per cent on $255,000,000.

Present Shipping Operations

The Commission estimates that 45,000,000 tons of freight, or enough to fill a line of freight cars reaching more than halfway around the world, entered or left the Port by water in 1914. The figure is less precise than that for the total rail tonnage, because of the character of the available data, but it is believed to be conservative.

The basic data of freight handled by water are principally in terms of ships and not in those of cargo. The Commission found it necessary to apply factors to the tonnages based on judgment and experience and the degree to which the ships indicated in the records were loaded, as well as to correlate the various units of weight and measurement, which are quite different in shipping practice from those of railroad practice.

In round numbers, it is estimated that, exclusive of Hudson River and Sound vessels, 8400 vessels with a capacity of 24,000,000 net tons (a net ton in shipping parlance being a unit of volume, 100 cu. ft., and not one of weight) cleared from the Port in 1914, and that these ships carried away 23,000,000 tons of freight of 2,000 lb. each. Imports are less in volume than exports at the Port of New York, possibly 20 per cent less, but enough Hudson River and Sound tonnage is accounted for to produce the estimated total of 45,000,000 tons.

COSTS OF CARGO TRANSFER

It would have been futile to attempt to compute the average cost per ton for the terminal operations of ships, as was done in the case of the railroads. Ships vary too widely, in the character and volume of their cargoes and the means for handling those cargoes.

A detailed study was made of the discharging and loading costs of two of the ships covered by the Commission's clockings. These ships showed direct discharging costs of $1.13 and $1.28 respectively per ton, and direct loading costs of $1.53 and $1.75 per ton respectively. The figures may be compared with the total of $1.64 direct costs of railroad car float terminal operations in 1918; but they are more directly comparable with the direct costs of handling operations at the terminal stations — 94 cents per ton in 1918 — inasmuch as they take no account of the cost of bringing the ship to port, of docking it or of maintenance of ship or pier.

Loading, which involves careful stowing in the ship, costs considerably more per ton than discharging, but either operation represents a sufficient expenditure to warrant careful study of ways and means to reduce it.

Railroad Service for Manhattan

The most pressing element of the entire port problem is that of railroad service to and from Manhattan. Manhattan is the district of greatest congestion, of most firmly established enterprises and customs, of greatest difficulty and expense in bringing about remodelling of facilities, because of high real-estate values, restricted quarters and physical isolation from other parts of the Port District. Its so-called "West Side problem" has been pressing for solution for a generation, and conditions have become such that a solution for the disposition of the New York Central tracks at grade must be found even if none could be found for the accommodation of the New Jersey railroads. On the other hand, the Commission believes it would be grossly derelict in its duty if, in its anxiety to solve the New York Central phase of the problem, it failed to provide for improved service by the New Jersey railroads. And a plan that provided for all of the railroads doing business on the West Side of Manhattan, yet disregarded the East Side and the New Haven and Long Island railroads which operate only on the East Side, would fall short of the complete solution.

Brooklyn, Newark and virtually every other part of the Port have a marked advantage over Manhattan. They have not the congestion, the restriction of area, the obstacles to bringing freight cars to the door of the shipper and consignee. Many sections of the

Port at present lack the railroad facilities they need for their development, but these facilities can readily be provided at costs commensurate with the tonnage possibilities. Only in Manhattan does the question arise whether it is feasible to bring in the standard cars of all railroads, or whether a substitute system must be found.

Many plans have been suggested for the solution of the West Side or the general Manhattan problem. Most of them fail under the acid test of economic proof. None that has been before the public seems to meet the requirements as well as one evolved by the Commission and recommended as part of the comprehensive plan. The Commission presents briefly the salient features of the chief plans it rejects, and its reasons for rejecting them, before describing in more detail the plan it recommends.

RAILROAD FOR STANDARD ROLLING STOCK

It has been persistently urged by more than one student of the problem that Manhattan could obtain adequate service from the railroads in only one way — by a railroad above or below the ground with physical connection to the New York Central and under or over the Hudson River to the New Jersey railroads, so that trains of standard cars could be brought to terminals in Manhattan, all railroads having equal opportunity. The Commission recognized the desirability of bringing the cars without breaking bulk direct to local freight houses and team tracks and to sidings of the larger industries. For this reason it made an exhaustive study of the possibilities of this proposal.

A railroad for standard rolling stock, the Commission is convinced, will never solve the problem. The great size of the plant required to handle the tonnage would render it unwieldy and difficult to operate, and the first cost and consequent interest burden would far more than nullify any saving in direct operating expenses.

The Commission has reached its conclusion after careful deliberation based on scientific analyses made by its engineering staff. The staff has designed in detail two systems — one with elevated tracks in Manhattan and the other with underground tracks — has traced through their capacities, has carefully estimated the costs of construction and operation and has found that neither is capable of economic justification.

Obviously cost and capacity are bound together in any project of this sort. The Commission had two questions to answer. Can any system be devised capable of handling the required tonnage? If so, can its cost be justified? Working on the assumption that the greater the capacity the lower the burden of overhead per ton handled, provided tonnage was available to utilize the full capacity, the Commission's staff expanded the elevated and subway plans to what was regarded the practicable limit with respect to size and capacity of joint yards in New Jersey, amount of trackage in any longitudinal thoroughfare in Manhattan, and number and size of terminals tributary to that thoroughfare.

When the plans were worked out it was not believed feasible to include any of the East River tonnage. The systems as tested were found barely capable of handling the 6,000,000 tons of West Side traffic they would have been called upon to handle in 1914, and would have had no room for increased traffic; while the interest and other fixed charges against the cost of construction would have been greater per ton of freight handled than the total cost per ton of operating with present facilities.

To handle the tonnage to be expected even in 1924 would require additional capacity, which could be obtained only by an additional and independent system. This second system would have to carry just as heavy a burden of fixed charges as the first, and no headway would have been made toward reducing terminal costs.

The plans worked out contemplated tunnels under the Hudson River as the cheapest form of connection between New York and New Jersey, but consideration was also given to the alternative of a bridge large enough to carry other traffic and make that traffic share the burden of cost. The bridge, analysis proved, would not show to any better advantage. The railroad freight train is too large and unwieldy a unit to come within the narrow and congested confines of lower Manhattan.

MOTOR-TRUCK SERVICE BETWEEN NEW YORK AND NEW JERSEY

In Cincinnati interchange of railroad freight in trap cars and local rail delivery and collection of freight at suburban stations have been to a considerable extent replaced by motor trucks with detachable bodies, operated on a schedule by a motor-truck company.

It was suggested that the system be applied at the Port of New York. Stations for the transfer of freight between cars and truck bodies, it was stated, could be built at the waterfront terminals of the several railroads and trucks could operate between these stations and zone terminals at any desired point in Manhattan, or to and from the store doors of establishments large enough to receive and despatch full truck bodies. It was pointed out also that while the motor truck could at the present time utilize the existing Hudson River ferries, special ferries for this service alone could be installed when the traffic warranted it.

This system has elements to commend it. The Commission is convinced, however, that its logical application at the Port of New York is to secondary rather than primary distribution. The Commission believes that it would be unwise to add this traffic to the existing vehicular traffic on the ferries, even though analysis shows that it might be accommodated; and that it would be unwise to impose this traffic on the streets along the Manhattan waterfront, inasmuch as one of the objectives in the solution of the Manhattan terminal problem is to reduce the truck congestion on the streets. Locating the transfer stations at the waterfront yards of the individual railroads would lessen the opportunity in the future of putting those yards wholly or in part to better uses, a fact which leads to the conclusion that the transfer point for such a system should be on the Hackensack Meadows at a joint yard.

The system shows upon analysis a greater cost per ton for handling freight than the one recommended by the Commission. The Commission cannot therefore recommend it as the best obtainable for the primary distribution of Manhattan freight to and from the New Jersey railroads.

CABLEWAY TRUCK-CONVEYOR SYSTEM

Another plan considered was a cableway system which would haul cars that could be attached to or detached from the cables at will and handled within the limits of the transfer or terminal stations by other means. In the particular design proposed small four-wheel trucks would be attached to cables operating through tunnels under the Hudson River and thence to terminals in Manhattan, the trucks being handled manually at the terminals.

The cableway system considered bears some resemblance to the automatic-electric system recommended by the Commission. It was found not so economical in its installation and operation, however, nor is any cableway system capable of such flexibility in operation or equal to the recommended system in capacity.

IMPROVED WATER-TRANSFER SERVICE

Retention of the present car-float system for Manhattan with certain modifications is favored by some. Wider piers, double-decked, would mean greater capacity and speed of transfer and the use of a smaller number of piers. Joint pier stations are as feasible as joint inland stations on any railroad, motor-truck or conveyor system, provided the stations are individually of sufficient capacity; and the enlargement, double-decking and conversion of some of the existing piers into joint stations would make possible the temporary abandonment of others and consequent release of considerable waterfront.

A joint marine service would eliminate duplication of equipment and would be a natural accompaniment to joint operation of pier stations. Joint operation or co-ordination of the waterfront facilities on the New Jersey side of the Port would also be necessary.

Improved water-transfer service for Manhattan has the great advantage that it would not involve any large initial outlay and could be put into effect gradually. The vital objections to it are that, far from releasing for steamship purposes the waterfront occupied by pier stations, the increasing traffic would require more and more waterfront; and that it would fail to dispose of the New York Central's West Side surface tracks. The Commission could not therefore recommend it.

The Plan Recommended — Automatic-Electric System

The Commission has evolved a plan which will release the Hudson River waterfront from pier-station occupancy, will afford some relief to the New Jersey waterfront, will dispose of the New York Central's surface tracks, will provide ample capacity for the future and will still effect a large saving in terminal costs. Furthermore, the plan lends itself to expansion as does no other one suggested. It can be made to serve all Manhattan and connect with the New York, New Haven & Hartford and Long Island railroads as well as the other railroads of the Port.

The plan is based on the general principle of a moving platform or continuous conveyor placed underground away from conflict with either surface traffic or subsurface transit lines. The system will resemble a railroad in appearance, but will function more as a conveyor, electric circuits instead of visible mechanisms holding the cars and trains in virtually fixed positions with respect to each other.

The essential elements of the system are:

A belt-line railroad in New Jersey reaching all of the New Jersey railroads that give pier-station service; a joint yard and transfer station on the belt line; two parallel but independent tracks of standard gage, running in a loop, mainly in separate tunnels, from the yard to Manhattan and back to the yard; a series of multiple-story terminals over the loop in Manhattan, with car elevators from the surface to underground siding tracks; a separate connection and transfer station in Manhattan for the New York Central Railroad; a fleet of special electrically operated cars, and a fleet of small four-wheel trailer trucks.

Inbound freight will be transferred at the joint transfer station to trailer trucks, which will be borne by the electrically operated cars, mainly in eight-car trains, to the Manhattan stations. The trains will be despatched as nearly as possible at uniform intervals and run at uniform rates of speed not exceeding 14 miles per hour, making it safe to move the trains at short intervals. At the stations the cars will be raised to the surface one at a time and their loads exchanged for trailers bearing outbound freight, after which they will be despatched in eight-car trains to the transfer station and unloaded into standard freight cars. The electric cars will move around the loop on either track in one direction only, each loop thus forming an independent line.

An important economic feature of this system is its automatic operation, as it is proposed that the electric trains shall be run between the joint railroad yards and the terminal stations in Manhattan without train operators, the trains being electrically controlled by the train despatcher and his assistants on the line. In this way there is substituted mechanical precision for the human fallibility of manual control. The system can be operated by either alternating or direct current, although alternating current seems to be the more advantageous.

In evolving this plan the Commission's engineers received the assistance, advice and collaboration of specialists in such methods of transportation, and the practicability of the automatic operation is endorsed by the leading electrical manufacturing companies and by electrical engineers consulted by the Commission.

A similar installation on a smaller scale is being made by the Post Office Department of the British Government in London. That department began a series of tests ten years ago and before the war interrupted the work had completed 6¾ miles of deep tunnel of 9-ft. diameter between the outlying railway stations and the General Post Office in the center of London. The electrical equipment for this system is now being purchased. As a result of these experiments it is planned to run and brake this system entirely automatically with speeds up to 35 miles per hour. An automatic interlocking block-signal system will be used with trailing dead sections of track.

The Commission's analysis of the automatic-electric plan it has developed includes estimates of construction and operating costs and of capacity. The results are so favorable that the Commission recommends its adoption, considering it to be the ideal system for general merchandise distribution for Manhattan. The body which is entrusted to finance and build the system should, of course, go farther into the many details of its design, which are not here covered, and make any necessary practical tests.

An initial development of the system to serve the New Jersey railroads and the New York Central in lower Manhattan has been fully analyzed by the Commission's engineers, and a plan has been prepared to expand the system to embrace the remaining railroads of the Port and extend the service to upper Manhattan.

Other parts of the Port, which, as previously pointed out, already enjoy direct rail service or can be provided with it, have at present no need for automatic-electric service, which Manhattan requires to release its waterfront in railroad use and to reduce the cost of handling its large volume of general merchandise freight. The automatic-electric principle, however, is applicable throughout the Port, wherever the congestion and volume of package freight reaches sufficient proportions to call for an auxiliary to the direct rail service. The limit of the Manhattan development will be reached when all of Manhattan has been served, but it is conceivable that other automatic-electric systems, linked up at the most convenient points to the extensive belt-line railroad system recommended by the Commission, will be warranted in the future in the interior of Brooklyn, Queens, the Bronx, the larger New Jersey cities and other sections of the Port.

INITIAL DEVELOPMENT OF AUTOMATIC-ELECTRIC SYSTEM

In the initial development it is proposed to link up the New Jersey railroads by a belt line along the eastern margin of the Hackensack Meadows and build a joint railroad yard in New Jersey east of the Croxton yard of the Erie Railroad. The automatic-electric tracks will start from this joint yard in New Jersey, pass under Bergen Hill and the Hudson River to a point in Manhattan at about Forty-seventh Street, thence turn southerly and pass under certain streets suitable for the location of convenient terminals, turning back to the joint yard via another set of tunnels in the vicinity of Battery Place. For estimating purposes a definite route has been selected which would serve most of the Manhattan section some distance back from the Hudson River waterfront. The exact location should not be adopted without further study by the authority charged with the duty of building the system.

The location of the system far below the surface in Manhattan will make it possible to construct it by tunneling methods rather than by the expensive cut-and-cover methods of work nearer the surface, with the necessity for underpinning abutting buildings and for maintaining existing sewers, water mains and other public utilities and conduits. It will also place the system entirely out of the way of the future rapid-transit construction Manhattan will require.

CYCLES OF OPERATION

A consignment of freight for one of the Manhattan terminals, coming in a train with freight for other parts of the Port District, will enter the existing break-up yard of the railroad company. Here the standard railroad cars will be classified as at present, and the car containing this shipment together with others containing other freight for Manhattan will be delivered to the public or private company operating the terminal system at the intersection of its belt line with the railroad company's line. The standard railroad cars will be hauled to the joint yard and placed in a receiving yard, whence they will be switched to tracks alongside the inbound ends of long transfer platforms.

Each of these platforms, twenty-four in number, will have a standard-equipment track on one side and an automatic-electric track on the other side. The freight will be unloaded from the standard railroad car upon trailers about 3 x 6 ft., and the trailers will then be hauled by tractors or by hand along the platform and placed upon one of the automatic-electric cars, which will hold twelve trailers. The standard railroad car will be pushed along the platform to the outbound end and reloaded with outgoing freight from other trucks, whence it will pass into an advance yard and be despatched to the railroad from which it came, or to any other railroad to which it is to be delivered.

The consignment of freight will meanwhile have been loaded upon one of the special electric cars — a car somewhat larger than the ordinary box car, with a roof to protect its contents, but roll sides to permit trailer trucks to be wheeled upon it at any point.

This car, controlled from alongside by a switch on the car within reach of an operator on the transfer platform or on the ground, will move from the platform at a low rate of speed (from 2.2 to 6.6 miles per hour) and be switched to a track assigned to the particular terminal to which the freight is destined, freight for only one terminal having been placed on the car. When sufficient automatic-electric cars have been accumulated, eight will be coupled together and despatched in a train. This train, with no other manual direction than the throwing of the track switch, will be accelerated to a speed of 1,200 ft. per min. (13.2 miles per hour) and take its place at not less than an established distance behind another train probably destined for a different terminal. The train will bear a distinctly visible indication of its destination, and when it reaches the entrance of its terminal an operator will throw a switch and divert it to a siding, where brakes will automatically be applied and it will come to a stop.

From this siding the automatic-electric cars will be run singly at slow speed upon an elevator. The elevator will raise the cars one at a time to an inbound platform at the street level and the cars will be run off under their own power. This platform will be the length of several cars, and each car will remain alongside the platform a minimum of twelve minutes, affording ample time for the wheeling off of the trailer trucks and the wheeling on of empty trucks. The consignment will be placed on the platform to be called for, as at the ordinary freight house, or removed to storage if the consignee fails to call for it within the free time limit.

The automatic-electric cars, having discharged their loads and received empty trailers, will be advanced one by one to a second elevator, which will lower them one floor to the outbound platform at the basement level. Here the cars, after having again at least twelve minutes in which to unload their empty trailers and receive loaded trailers with outbound freight, each car receiving freight for a single railroad, will proceed back to the original elevator shaft. The cars will then be run upon the first elevator and be lowered to the track level, this elevator having meanwhile made several trips and brought other cars to the inbound level.

Running off the elevator at the side-track level, the automatic-electric cars will be held until eight have accumulated, when they will be coupled and despatched as a train by exactly the same process as from the New Jersey yard, an interlocking signal system controlling the time when the train shall enter the main-line system.

Arriving at the joint yard, the train will be switched to one of the tracks of a receiving yard, where it will be brought to a stop automatically as before. Here the automatic-electric cars will be cut off one at a time, and started by an operator walking alongside, the cars moving at a speed of 2.2 miles per hour. They will proceed over a series of switches and crossovers, controlled from a central tower, by which they will be diverted to the proper tracks at the transfer station.

The cars will be stopped at the outbound ends of the transfer platforms. The loaded trailers will be removed and transferred to standard freight cars, other trailers previously emptied will be hauled by tractors along the platform to the inbound end of the platforms, the empty automatic-electric cars will be advanced to the inbound section of the transfer station to receive new loads, and the cycle will have been completed.

An important feature of the automatic-electric system is the contemplated trailing dead section of track, which will make it impossible for one train to come closer than a certain safe distance from the train preceding.

NEW YORK CENTRAL CONNECTION

A special connection is required in the initial development to accommodate the New York Central Railroad. It is proposed to establish at the New York Central's Sixtieth Street yard a transfer station similar in character to that in New Jersey, from which will be constructed a double-track connection to the main loop.

Incoming New York Central trains of automatic-electric cars will enter the main system at this junction and pass south into the terminal system in the same direction and in the same manner as New Jersey automatic-electric trains until they reach the desired terminal. Outgoing New York Central automatic-electric trains will continue south, follow the south tunnels to New Jersey, be detoured around the joint yard, come back upon the main system at the north end of the joint yard, move east through the main system and be switched to the spur running to the Sixtieth Street yard.

NON-INTERFERENCE WITH PRESENT OPERATIONS

Inasmuch as the Manhattan terminals and main line of the proposed automatic-electric system are to be located inland from the waterfront, and the New Jersey belt line and joint yard will be on ground at present unoccupied in the Hackensack Meadows, the initial development of the automatic-electric system as outlined in the preceding paragraphs can be constructed, equipped and placed in operation without in any way hampering the operation of present facilities. The importance of this feature will be realized when it is considered that the estimated period required for the construction of this system under the most favorable circumstances is three years.

Certain other projects that have come before the Commission would require tearing up existing tracks or abandoning certain piers to make way for the new construction. Such a procedure would greatly add to the existing congestion and produce a well-nigh intolerable state of affairs that would inevitably last for several years. Any attempt to construct a new system piecemeal on the site of existing facilities would greatly extend the construction period as well as increase the cost.

MANHATTAN TERMINALS

Twelve Manhattan terminals will be required immediately. Five more, it is estimated, can subsequently be added before the terminal capacity reaches the capacity of the joint yard and main tracks.

Much depends upon the design of the terminals in Manhattan. The handling costs at the present pier stations have been found to be the largest single item of expense of railroad terminal operation, not to mention the enormous cost incident to truck delays resulting from congestion. These high handling costs are attributable to several causes, foremost of which are lack of platform space and congestion of drays. The Commission has sought to avoid the same mistakes in its proposed inland terminals. Abundant driveway and platform space have been provided, inbound and outbound freight will be handled at different levels, and the arrangement of driveways is such that there will be no conflict of trucks coming to the terminal for different purposes, the traffic on certain of the adjacent streets being restricted to one-way operation.

To provide ample space for holding inbound freight awaiting consignees, and storage space as well for spare trailer trucks, it is proposed to build a floor above the inbound level as a part of each terminal. Above that it is proposed to build two additional stories for warehouse purposes, and it is estimated that the revenues that can be obtained from these additional floors will contribute materially to a reduction of the fixed charges against the system. Besides the two warehouse floors incorporated in the design, estimates have been made of the extra cost of and revenues obtainable from two additional floors per terminal for loft, manufacturing or office purposes.

It is proposed to provide two main tracks for the main system and an independent elevator and platform system for each main track at each terminal. At each terminal there will therefore be two car elevators that run the entire vertical distance between the deep-level tracks and the auxiliary terminal floor just above the street level, and two other shuttle car elevators that run between this floor and the outbound floor just below the street level.

TWO SYSTEMS IN PARALLEL

Assurance against complete suspension of service through accidents is important in a system such as the automatic-electric. This is provided in large measure by the division of the plant into two separate and parallel systems. There are two main tracks, each with its own tunnels, each with its half-terminals complete as to sidings, elevators and platforms. An accident to one elevator would merely incapacitate one-twenty-fourth of the terminal facilities. Even a derailment on the main line would leave half of the plant in commission.

It is proposed to have emergency connections with the power plants of the large public utility companies operating in Manhattan to insure against failure of the electric power.

CHARACTER OF TRAFFIC TO BE HANDLED

Virtually all of the traffic now handled at the railroad pier stations and at the freight houses of the float-bridge terminals can be handled economically on the recommended system. The team-track and heavy freight of the float-bridge terminals cannot be accommodated, and these terminals should be retained. This would also include the Thirty-third Street yard of the New York Central, which has float-bridge connections not in present use. The St. Johns Park Terminal of the New York Central should be abandoned and the New York Central tracks in Tenth and Eleventh Avenues removed.

Much freight not now handled at the pier stations can be taken care of admirably in the new system. This applies particularly to milk, and to other perishable food unloaded in New Jersey and trucked to New York. The suggested method of handling these commodities by the automatic-electric system is part of the Commission's plan for improving the Port's system of food distribution, and is set forth more fully elsewhere in the report.

The system is also well adapted to the handling of express packages. At present the express companies are poorly equipped in the way of terminals to serve the public in a satisfactory manner. An express station at each automatic-electric terminal will make for a much improved express service.

It is not essential that all freight carried by the automatic-electric system be carried on trailer trucks. These trucks will be convenient for most commodities to reduce rehandling. Shipments that will not go on the trailers can be loaded directly upon the automatic-electric cars, or placed in detachable motor-truck bodies which can be hauled through on the automatic-electric cars, and delivered at the terminals to motor-truck chassis which will take them to the store door.

It will also be possible to bring a certain number of standard cars through the system and into the terminals. This practice will probably not be much resorted to, inasmuch as the bulk-breaking facilities at the transfer yards will be adapted to every commodity the system can handle.

COMPARATIVE CAPACITIES AND COSTS

With twelve Manhattan terminals the initial development of the automatic-electric system, normally operated ten hours a day, has an estimated capacity of 10,000,000 tons yearly, the tonnage expected in 1929. The estimated yearly capacity of the steam belt line, joint yard and Hudson River tunnels is 14,260,000 tons, and the capacity of the entire system can be brought to that figure by building five additional terminals. The capacity of the present facilities is indeterminate, but the congestion at times indicates that it is not in excess of the present peak loads. Table 1 compares the capacities of the recommended system and the present facilities, the capacity of the latter being assumed as that of the maximum short-period traffic found by the clockings sustained for a year. The capacities of the elevated and subway systems for standard equipment are also shown for comparison. They, moreover, are based on operation for 24-hour days.

Table 1 — Estimated Maximum Capacity

	Tons of freight per year	
Automatic-electric system	14,260,000	
Present car float-pier station system	8,000,000	
Added capacity	6,260,000	77.8%
Standard-equipment elevated system	6,115,000	
Standard-equipment underground system	6,115,000	

Table 2 shows for comparison the estimated costs of construction and equipment, ready to operate, of the automatic-electric, the standard-equipment elevated and the standard-equipment underground systems. The automatic-electric figure covers twelve Manhattan terminals, which will give an estimated capacity of 10,000,000 tons. All three figures are based on 1918 prices, which the Commission deems as nearly normal for the future as can be obtained. In this and the succeeding tables the interest rate for money borrowed for construction is assumed at 5 per cent. Amortization of the entire investment in fifty years is provided in all of the automatic-electric estimates that follow, but not in those for the other systems.

Table 2 — Estimated Cost of Construction and Equipment at 1918 Prices

Automatic-electric system	$201,190,000
Standard-equipment elevated system	241,131,000
Standard-equipment underground system	255,009,000

Table 3 shows the estimated cost per ton of operating each plant, and the costs at those rates for moving 10,000,000 tons of freight per year. The automatic-electric system alone has a 10,000,000-ton capacity, but to show the other systems as favorably as possible this fact is disregarded. Expanding them to the desired capacity would require much new construction, entailing additional fixed charges that would undoubtedly keep the unit costs of operation, which include both direct costs and fixed charges, at least up to the figures recorded.

Table 3 — Estimated Cost of Moving 10,000,000 Tons of Freight From Break-Up Yards to Manhattan Stations at 1918 Prices

	Per ton	Ten million tons
Present car float-pier station system.	$2.25	$22,500,000
Automatic-electric system..........	1.82	18,200,000
Saving, automatic-electric system.	$0.43	$4,300,000
Standard-equipment elevated system	$3.47	$34,700,000
Standard-equipment underground system........................	3.66	36,600,000

Thus the advantage of the automatic-electric system over either standard-equipment system is overwhelming in capacity and cost of operation, with less capital investment, and consequently the standard-equipment system can be excluded from further consideration.

RETURN ON INVESTMENT

The advantage of the automatic-electric system over present methods is marked as to both capacity and cost. The increased capacity alone would not justify the new system, but the difference of 43 cents per ton in operating costs means that the system will pay 5 per cent on the investment and save 19 per cent of the present cost of the terminal operations covered in the railroad rate.

This is not, however, the only saving possible through the automatic-electric system. It is but one of fourteen items listed in Table 4, in every one of which the public is directly or indirectly concerned.

Item 1 is that indicated in Table 3, amounting to about 43 cents per ton or $4,318,000 on 10,000,000 tons. It includes (a) the direct advantage of the automatic-electric system over present facilities in the sum of direct costs, fixed charges and credits from two revenue-producing warehouse floors in each terminal; (b) the estimated value of an average saving of two days in the cycle at the Port of the railroad cars handling the freight, and (c) the estimated saving through material reduction in the movement of empty cars. (At present approximately 25 per cent of the cars in Manhattan pier-station service move empty one way.)

Table 4 — Saving by Automatic-Electric System on Basis of 10,000,000 Tons Handled Annually

1. Saving over present system in railroad operation........................	$4,318,000
2. Saving in truck delays..................	1,648,000
3. Saving in trucking distances............	1,154,000
Total............................	$7,120,000
Per cent above 5% interest on $201,190,000	3.54%
4. Net rentals from two additional loft floors.	6,416,000
Total saving.....................	13,838,000
Per cent above 5% interest on $218,630,000	6.22%

Important Items of Saving Impracticable to Estimate Accuratel

5. Increased average loading of railroad cars.
6. Increased average loading of trucks.
7. Saving to public through quicker terminal movement.
8. Reduction in trucking expense to tenants of terminal buildings.
9. Reduction of trucking of milk, produce and live poultry from New Jersey.
10. Inherent possibilities of saving in spoiling of food.
11. Decreased maintenance in city streets.
12. Freedom from interruption by fog and ice.
13. Increased real estate values.
14. Increased commercial capacity of all Manhattan.

Items 2 and 3 are direct public benefits arising from eliminating congestion and consequent idle time of trucks at stations, and from making every station a receiving and delivery point for every railroad using the system.

The sum of items 1, 2 and 3 represents a saving to the community of $7,120,000 per year, or a net return on capital investment required of 3.54 per cent in excess of the interest and amortization charges. This saving and percentage of return can nearly be doubled (item 4) by building and renting two additional loft floors in each terminal, the cost of which will be only $17,440,000. This will increase the total calculable saving to $13,838,000 per year, or a net return on the capital investment of 6.22 per cent over the assumed fixed charges.

Items 5 to 14 are difficult to estimate but none the less important. The average load per car in the Manhattan general-freight service will undoubtedly increase when it becomes possible to consolidate loads for or from the joint yards. Establishing union stations in Manhattan will likewise probably make for consolidation of truck loads to and from the local merchant and manufacturer. Reducing the cycle of terminal operations will expedite the shipper's freight and help his business. Occupancy of lofts in terminal buildings will possibly entirely eliminate the trucking expenses of the tenants. Incorporation of the food-distribution changes the Commission recommends with the automatic-electric system will render it unnecessary to truck milk, produce and live poultry to Manhattan as at present from the waterfront yards in New Jersey, and will by lessening the delays to and exposure of all kinds of perishable foodstuffs greatly reduce spoiling. All of these reductions in trucking, through reduced delays, reduced distances, increased loads and the substitution to a large extent of automatic-electric delivery, will have a marked effect on the wear and tear on our city streets, and the consequent maintenance costs. Freedom from interruption of railroad service by fog and ice will have its value. And finally, the generally improved conditions will make Manhattan and the entire Port a more desirable place in which to do business, will give it a greater capacity for doing business and will have a generally beneficial effect on real estate values.

These specific items of saving attaching to the automatic-electric system itself merge into other public benefits made possible by the system, some of which perhaps have no money value, but all of which make for the convenience and comfort of the community. In this category is the adaptability of the system to voluntary store-door delivery and to the improved food-distribution system recommended by the Commission. In it also is the release of waterfront on both sides of the Hudson River sorely needed for steamship terminals. All of these benefits are discussed at greater length later on in this report. They add to the many reasons why no one in the Port District can regard the Commission's proposal as of no concern to him.

EXPANSION OF SYSTEM

The initial development of the automatic-electric system described in the foregoing paragraphs solves the West Side problem south of Fifty-ninth Street and gives adequate relief where it is most necessary. It leaves to be provided for by expansion of the system the inclusion of the New York, New Haven & Hartford and the Long Island railroads and the removal of the New York Central tracks through Riverside Park. The comprehensive plan recommended by the Commission meets both of these points by means of an additional loop in upper Manhattan connecting with the initial development and also with a second joint yard on the East River to serve the three New York railroads. While the Commission believes that Ward's and Randall's Islands might best eventually become public parks and that suitable locations for such a yard may be found in that vicinity by the Port Authority on the Bronx or Queens shores, the Commission's map, merely for purposes of illustration, shows such a typical yard on the city's property rather than on private property.

This expanded system, with a line on the West Side, another on the East Side, and a third auxiliary loop on the lower East Side, makes it possible to build additional stations in territory not now served by rail, at the same time admitting the New Haven and Long Island railroads and giving all railroads equal opportunity at all stations.

The amplified plan offers the one full solution of the problem of the New York Central's West Side tracks from Spuyten Duyvil. The plan contemplates bringing the New York Central's general-merchandise freight, perishable foodstuffs and express business along the Harlem River from Spuyten Duyvil on additional tracks to the proposed East River yard. Any other classes of New York Central's freight can then be handled either over the West Shore system or at a new waterfront yard east of the Hudson. The West Side tracks can and should then be removed, and thus the entire troublesome problem of whether they can be made unobjectionable by depressing them or moving them farther into Riverside Park disappears.

In addition the plan recommended has this advantage — it will continue the service of the present system without interruption while the new system is being constructed and made ready.

The additional tracks between Spuyten Duyvil and the proposed East River yard should be built as a part of the comprehensive plan, and should be available on equitable terms to all railroads of the Port.

Railroad Service for Long Island

Brooklyn, the second most populous section of the Port, depends for railroad service on a small number of piers and float-bridge stations operated by the railroads, on some half dozen private terminals reached by float bridges and served internally by fragmentary belt-line railroads, and on local service rendered by the Long Island Railroad. The Brooklyn waterfront is an attractive one for shipping and for industrial development, and most of that part from the head of Newtown Creek to Bay Ridge is intensively developed.

For a number of years efforts have been under way to bring about the construction of a continuous marginal railroad from Bay Ridge as far north at least as the Brooklyn Bridge. During the war consideration was given to a further extension of this to the head of Newtown Creek.

The Commission believes that such a belt line would not be satisfactory. The line would be about thirteen miles long, and switching operations would be required throughout its length to serve the numerous piers, warehouses and industrial plants flanking it. This would interfere with the hauling of cars over the line and would probably cause continual congestion.

This congestion can be overcome by building the line in short sections with independent feeders. For some time to come float bridges can be relied on exclusively as feeders. When the traffic becomes too dense, railroad spurs can be built to the line from the Long Island Railroad and the New York Connecting Railroad. One such spur can be extended from the Bushwick Terminal to the end of the line at the head of Newtown Creek. The other can be built to the southerly end of the line at Bay Ridge and a connection over or under the ground can close the gap at Gowanus Canal, thus reducing the number of sections from three to two.

Much of this railroad system as outlined is already in existence with the float-bridge connections. New construction can fill the gaps and give rail service to all parts of the developed Brooklyn waterfront.

The system should be extended into Queens in the manner outlined on the general plan. Queens, with its vast area, has wonderful possibilities for industrial development. Thus far it has been handicapped by lack of railroad facilities, having no pier stations, only two small private terminals and no belt-line system. The existence of the New York Connecting Railroad and various parts of the Long Island Railroad makes it a comparatively simple matter to provide railroad facilities similar to those recommended for Brooklyn.

Jamaica Bay can easily be reached by a spur from the Long Island-New York Connecting belt line, and such a spur should be built.

The construction of the expanded automatic-electric system and the proposed connection from Spuyten Duyvil to a new joint yard at or near the East River will fit into the plan of service for Long Island, giving the New York Central access to the entire Long Island district.

This entire plan of service calls for the use of the Long Island Railroad and the New York Connecting Railroad from Bay Ridge to the Bronx by all railroads on equitable terms. The line is now controlled by the Pennsylvania and the New Haven railroads for their own purposes in the interchange of freight between Pennsylvania territory and New England. A way can be found to bring about joint use of the line, just as a way must be found to bring about joint use of the waterfront belt line in New Jersey, now owned by three of the New Jersey railroads.

For some time to come connection between New Jersey and the Long Island belt system can be afforded by a car-float line from the Bayonne section to Bay Ridge. Running between two fixed points, with full loads at all times, such a ferry will not be expensive to operate. Ultimately, when the traffic warrants, the ferries can be replaced by a tunnel under the Upper Bay.

Belt-Line Railroad System

The Long Island belt-line railroad system would form a part of a more comprehensive belt system for the entire Port. In New Jersey the Commission recommends that there be three classes of belt lines, designated as inner, middle and outer belt lines — all joined in a comprehensive and flexible whole.

INNER BELT LINES

The primary purpose of the inner or waterfront belt lines is to serve steamship terminals and industries along their routes.

Nuclei for two such belt lines already exist — one the fragmentary Brooklyn marginal railroad referred to on the preceding page, the other The National Docks Railway, the New Jersey Junction Railroad and the Erie Terminals Railroad, which collectively extend along the east base of Bergen Ridge and the Palisades from Bayonne to Edgewater. Both will require improvement as to alignment and trackage.

A number of other marginal railroads are indicated on the comprehensive plan along other navigable waters in both States. The proper sequence of construction should be determined by the permanent Port Authority in collaboration with the communities affected. The lines need not be continuous, but each must have easy access to the other parts of the belt-line system.

MIDDLE BELT LINES

There should be one middle belt line on each side of the Hudson. The Long Island-New York Connecting Railroad and the line recommended along the Harlem River from Spuyten Duyvil to the East River will constitute the middle belt line for New York. That for New Jersey will have to be built, and should extend along the east side of the Hackensack Meadows as shown on the comprehensive plan, connecting with all of the railroads.

The primary purpose of the middle belt lines is to afford a means for the direct interchange of cars between railroads and a thoroughfare for all of the railroads of the Port o and from the joint car-float and joint lighterage stations recommended by the Commission. Because these cars almost invariably require classification at the break-up yards, the proposed belt line in New Jersey is located wherever possible just east of those yards.

OUTER BELT LINE

The third class of belt line, the outer belt, is at first required for New Jersey only. It should encircle the entire western half of the Port, from tidewater on New York Bay to tidewater well up the Hudson River, passing outside of the break-up yards. Its chief immediate purpose is to serve as a bypass around the congestion nearer the waterfront for all freight that need not pass through the break-up yards, and as an auxiliary to the middle belt line, the capacity of which bids fair to be taxed by the increased traffic of the next decade. The traffic that can be diverted may include trainload shipments to and from steamships, interchange between the New York Barge Canal and the New Jersey railroads, railroad interchange originating at or destined for points beyond the break-up yards, such as Paterson, and traffic between the New Jersey railroads and Yonkers and the communities to the north of that city, which can be reached from Piermont by a car-float service.

This is by far the most extensive of the belt-line projects recommended, and the one requiring the most extensive study. A tentative location has been established through a survey made for the Commission by the forces of the State Engineer and Surveyor of the State of New York.

The line as located will begin at Piermont, N. Y., on the Hudson River, pass southwesterly to the west of Paterson, N. J., and the Orange Mountains, come through the Orange range near Summit and continue in a generally easterly direction to termini on deep water, reached by short branches. It is proposed to establish one such terminus on Newark Bay, one in Bayonne along the Upper Bay, one on the east shore of Staten Island and one on the Raritan River.

Steamship terminals will naturally be built at each of the southern termini, and a Barge Canal terminal at Piermont. A large classification yard will be required on this outer belt line, probably in the vicinity of Newark Bay, and the middle and inner belt systems should be connected with the outer belt near that yard.

In a relatively short time the railroads will need to add to their break-up yard facilities, and the additions will presumably be built at the junctions of their lines with the outer belt. These additions will enable the outer belt to serve more and more as a relief to the middle belt.

All of the new belt lines will open up new territory for industrial development, and should in time handle a large amount of local industrial traffic.

Consolidation of Railroad Marine Operations

The automatic-electric and belt-line systems will relieve the harbor of much of its car-float movement and doubtless some of the lighterage movement.

When all of the railroad links embraced in the comprehensive plan are in operation, however, which will presumably not be for a number of years to come, there will still be car floats and lighters. There will be team-track yards in Manhattan, Brooklyn and elsewhere, and doubtless pier stations outside of Manhattan, to be served by car floats; there will be loading of ships from lighters simultaneously with loading from the piers, and there will be local lighterage deliveries of bulk freight throughout the harbor.

The harbor waters, reaching their 800 miles of frontage, have a flexibility not attainable in any railroad system. To depend almost wholly on water transfer is undesirable; to disregard the utility of water transfer for many kinds of terminal service is equally undesirable.

Consolidation is the keynote to economical marine operations. At present there is wasteful duplication. Nearly every railroad in the Port has its independent fleet of tugboats, car floats and lighters, its independent pier stations, even in outlying districts of little business, its independent float bridges, float-bridge yards and lighterage piers.

Consolidation of fleets is recommended, to make it possible to operate with a much smaller total of boats at a higher load factor. Joint car-float and joint lighterage receiving stations, separated to avoid congestion, should be built at new railheads on shallow waters not suited to shipping, thereby releasing the present railhead occupancy for steamship terminal development and at the same time giving steamship companies and private terminal companies throughout the Port the great advantage of receiving and delivering their railroad goods at possibly six points instead of nearly twenty. Whether existing pier stations not eliminated by the automatic-electric system should be operated jointly or by the individual companies may be left for future decision, but joint stations can easily be established in outlying districts not capable of supplying the individual roads with enough traffic to justify separate stations.

Here again the need for a port authority is apparent. During the war the United States Railroad Administration, having jurisdiction over all railroad property regardless of State and municipal lines, made a start by putting some of the existing facilities to joint use. To make the plan thoroughly effective the existing facilities must be remodeled, and the remodeling must all be done under the supervision of one agency.

Ultimate Electrification

Steam is the present motive power for nearly all of the railroad freight movement in the Port District. Except in the case of the automatic-electric system, and certain of the standard-equipment lines where for one reason or another steam operation would be objectionable, the recommended lines will presumably be built for steam operation. They should be built, however, with a view to future electrification. Railroad electrification has made great strides since the beginning of the twentieth century, and it is probable that in the not too distant future all railroad terminal districts will be electrified, both to eliminate the smoke nuisance and to effect economies of operation.

Measures for Immediate Relief

While the automatic-electric system, the belt-line system and the joint car-float stations and lighterage stations can all be built and put into operation without interfering with present operations, several years will be required to do this. Meanwhile two steps can be taken at once to bring about partial relief in the face of the growing congestion. One of these is the consolidation of marine equipment, the other is the inauguration of " voluntary store-door delivery."

Consolidation of marine equipment need not await consolidation of terminals at any point. The advantages of a single large fleet of tugs, car floats and lighters in place of a number of independent fleets can be realized immediately.

" Voluntary store-door delivery " offers a still better opportunity for relief. Investigation has shown that probably thirty per cent of the railroad business of Manhattan is in carload lots, and a considerable amount of that of the other sections of the Port is in large consignments. The congestion at pier and other freight stations can be materially relieved by bypassing this freight and making pickups and deliveries direct between these large companies and the railroad yards. This will involve what might be termed a " partial or voluntary store-door delivery." A direct motor-truck service would be inaugurated between transfer platforms constructed at the railroad yards and large shippers in Manhattan and elsewhere in the Port.

To avoid rehandling of the freight there should be a considerable number of detachable truck bodies with a comparatively small number of chassis, so that goods could be transferred from the car to the truck body at the transfer platform and delivered direct to the consignee. The service should be controlled by some suitable medium between merchant and railroad.

These measures for immediate relief involve no expenditures not utilized in the ultimate plan other than the construction of a few transfer platforms — for the motor-truck chassis, detachable bodies and voluntary store-door delivery should remain as auxiliaries to the automatic-electric stations — and the Commission urges that they be adopted at once.

Markets and Food Distribution

Bound up with the railroad freight problem of Manhattan is the system of markets and food distribution. This is one of the most important as well as difficult phases of the Port problem — one that comes closest to the public, inasmuch as it affects the price and quality of food put on the table at every meal.

New York is the market center of the country. Foodstuffs, perishable and otherwise, are shipped to New York from Maine, from California, from Texas, from Florida. The shippers rely largely on commission men to find a market. There is no agency for controlling this constant inflow, storage facilities are limited and the market frequently becomes so glutted that goods spoil before they reach the consumer.

On the lower West Side of Manhattan has grown up the primary market for these goods. Here the railroads have pier stations devoted mainly to foodstuffs, and several of the coastwise and transoceanic steamship companies handling foods in large quantities have their piers. The goods undergo a series of sales, varying with the commodity and other conditions. In the primary market itself, which includes stores along or in the vicinity of Washington Street for a distance of half a mile, we find commission men, auctioneers, wholesalers and jobbers. Their customers are retailers from lower Manhattan, buyers for hotels, restaurants, hospitals and other institutions, and wholesalers and jobbers from other markets, such as the Wallabout Market in Brooklyn, which depend mainly upon the primary market for their supplies. The customers of these secondary markets are in turn retailers from the areas they serve, together with a few large consumers.

At whatever point the goods are consumed, they come first to the primary market, where they encounter the largest number of prospective buyers; attempts to bypass this market, as through direct shipments to the Wallabout Market, have been generally unsuccessful. Each stop of the food means additional delay, additional handling, additional waste and additional cost to the consumer. Yet the system is the growth of many years, and those engaged in it are seemingly agreed that it cannot successfully be changed.

No one will deny that the present system is highly unsatisfactory. There must be fewer handlings. The resident of the Bronx should not be obliged to pay to have his apples loaded upon a truck at a pier station, hauled a few blocks, unloaded at a Washington Street store, loaded upon another truck and hauled to Harlem Market, unloaded and reloaded at this point and trucked a third time before he sees them at his local grocer's. Newark's residents must be able to intercept produce passing through on the Pennsylvania Railroad before it is unloaded at Jersey City, ferried across to the primary market in New York and ferried back to New Jersey.

The simplest way to remedy the situation might appear to be to break up the primary market and establish independent primary markets in the Bronx, Brooklyn and other populous sections. To attempt to do this abruptly, the Commission is convinced, would be a fatal mistake. While changed methods are called for, the changes should be evolutionary and not revolutionary. The need is not so much for the elimination of the dealer in the primary market and the secondary market as for the elimination of the actual movements of the food from one dealer to another. This can be accomplished by the providing of food receiving stations where the goods can receive proper care while awaiting distribution, and by a system of sampling and certification under public direction. Buyers will then find it necessary to see only the samples at the primary market, and their orders can be filled by direct shipment from the receiving stations.

The principal receiving station, as conceived by the Commission, will be at or near the joint yard of the automatic-electric system in New Jersey. Goods from this station can be shipped on trailer trucks, or, if they require refrigeration, on special truck bodies, to any desired station on the automatic-electric system, which covers virtually all of Manhattan. The Bronx will be reached through the station in that borough, around which will naturally grow a secondary market. Brooklyn, Queens, Staten Island and New Jersey points will be reached by the belt-line railroad system recommended by the Commission as part of its comprehensive plan.

The food receiving stations referred to will include dry and cold-storage warehouses, sampling rooms, facilities for reconditioning and grading. Commodities such as dressed meat requiring a constant temperature will be transferred from the railroad cars to special truck bodies in rooms where the required temperature is maintained, thus removing the objection of transfer before ultimate destination is reached. Milk trains will run to these transfer stations instead of to the waterfront terminals, and the milk containers will there be transferred to special truck bodies which can be placed on chassis and moved to the pasteurization plants or hauled on the automatic-electric cars to the stations nearest those plants.

Foodstuffs can be shipped from the food receiving stations of the joint yard to any of the terminals on the automatic-electric system, from which the goods can be trucked to the present primary market. In the course of time, however, it is probable that the wholesalers and jobbers will see the advantage of relocating nearer the terminals. Market structures far better adapted to the business than the old and small buildings of the present primary market can be built adjoining the terminals, with overhead access so that trailer trucks can deliver the goods to the market. In this way the congestion and insanitary condition of the present market will be overcome, but by an orderly voluntary process of the dealers, and not by any attempt to force them to definitely established quarters.

Certain steamship piers can be equipped with receiving stations of the same character as those suggested for the joint railroad yards, and can be linked up by a trucking service to the market terminals above outlined.

Better Use of Waterfront

New York's waterfront structures, except in the case of a few piers of recent construction, are inheritances from other days of different requirements. When ships, cargoes and the entire traffic of the Port were small, narrow single-decked piers seemed to fill every need, and the lack of storage space was not felt. Subsequently the facilities were outgrown.

The Department of Docks of the City of New York has always been compelled to work within certain limitations — both by provisions of the city charter and at times under financial limitations — but has from time to time replaced old and inadequate piers by more modern types and at present has large plans under way for Manhattan and Staten Island referred to elsewhere in this report.

The limitations of the city's charter may operate, unless changed, to prevent the City of New York from keeping pace in the development of that portion of the waterfront over which it retains control with the developments of other portions of the Port which may come under the control of the proposed Port Authority. This Commission invites attention by the Legislature of the State of New York to this question, and there may be like inhibitions or limitations in the laws of New Jersey which may also require revision.

Adequate reorganization of the waterfront as a whole, like adequate reorganization of the railroad system, can be brought about only by large-scale operations under the direction of a central authority, working from a comprehensive plan.

HUDSON RIVER WATERFRONT IN MANHATTAN

The Hudson River frontage of lower Manhattan is the most sought-for waterfront in the Port. The Commission has therefore given it special attention and has worked out a plan for reconstructing the facilities from the Battery to Fifty-ninth Street.

Last spring the Commissioner of Docks of the City of New York submitted to the Sinking Fund Commission a plan involving the reconstruction of the piers from Fulton Street to Perry Street, and that body adopted the plan on July 29 last.

The Commissioner of Docks has deferred presenting to the Sinking Fund Commission a plan for the section above Perry Street pending a decision by the Secretary of War on an application of the City of New York for an extension of the pierhead line from Perry Street to Seventy-second Street.

Plans for developing other sections of waterfront have been formally adopted by various municipalities within the Port, and in the absence of conflict with its conception of the needs of the Port as a whole this Commission has incorporated those plans in its own showing suggested methods of sectional development. Following this policy the Commission has included the city's new West Side waterfront plan between Fulton and Perry Streets in its more extended plan.

The basic features of the combined plan are:

1. Replacement of most of the existing piers with a smaller number of wider piers, double-decked and extending in all cases to the pierhead line, and with wider slips.
2. Construction of a series of multiple-story warehouses on the Marginal Way.
3. Provision of freight driveways at both pier-deck levels, with adequate ramps leading to the upper level.
4. Provision of ample tailboard space and tractor-trailer service between tailboard and ship.
5. Construction of a continuous elevated esplanade adjacent to the river for pleasure vehicles and pedestrians.

With the abundant pier floor space, adequate warehouse facilities immediately at hand and adequate mechanical appliances, the proper function of the piers as transit sheds for the quick discharging and loading of ships, instead of as an overworked and inefficient combination of transit shed, warehouse and driveway, can be restored. By handling outbound cargo at the street level and inbound at the upper level, drays in the two classes of service can be separated and congestion practically eliminated.

The elevated esplanade, while not a necessary part of the plan, can be provided at not very great additional expense and will supply an attractive and much-needed longitudinal thoroughfare for passenger vehicles and a breathing space for the inhabitants of the city.

The city's plan fills with piers the spaces now occupied by the ferries, on the assumption that as vehicular tunnels are built the need for the ferries will diminish and ultimately they can be discontinued. It is understood, however, that only as it becomes practicable to discontinue each ferry will a pier be built on the site it uses.

HUDSON RIVER WATERFRONT IN NEW JERSEY

No waterfront in New York Harbor is more desirable for freight steamship terminals than the west bank of the Hudson River and the Upper Bay. The trunk-line railroads are there, and the position is ideal for steamship piers with direct and universal railhead service. Instead we find occupying most of the frontage a series of heterogeneous railroad terminals, each with its yards, float bridges, lighterage piers and special facilities to serve its particular purposes, and little space is available for steamship piers.

A complete reorganization will be possible if the comprehensive plan is carried out. Diversion to the belt lines, the joint car-float and lighterage terminals and the automatic-electric system of so much of the present traffic of the waterfront yards will make it possible to put about eighty per cent of the frontage they occupy to uses more in keeping with its values, with the need of the communities for more extensive steamship terminals and with the need of the whole Port for more facilities for direct transfer between car and ship.

The railroads can build the piers themselves and lease them to the steamship companies, they can sell the lands to the steamship companies or the communities can acquire them for such uses.

Development of Other Sections of the Port

Much study has been given by the Commission and its engineers to determining the best forms of development for other sections of the Port.

Some of the sections having great possibilities of development are at present without railroad facilities, which are their first need. The comprehensive plan if put into execution will supply that need.

Some are without suitable channels. The Commission elsewhere recommends channels that with those now authorized by the Federal Government should be adequate for their water-borne commerce.

A third form of access, by highway, is essential, but the details of this must be worked out by the municipalities affected.

The general topography and the distance of the section from the points of greatest activity in the Port should have a bearing on the character of development chosen for the section.

There are undeveloped waterfronts with comparatively narrow uplands within a short distance of the heart of the Port — such for example as parts of the east and north shores of Staten Island and parts of the Weehawken waterfront. Freight steamship developments, with piers and bulkhead warehouses, are immediately suggested for these sections.

A little farther away, in various parts of the Port District, are extensive tidal marsh lands. These lands offer unrivalled opportunities for development as auxiliary ports combining industrial and commercial development with port facilities. Many of the great world ports of Europe, such as Antwerp, Hamburg, Marseilles, London, Liverpool, Manchester and Glasgow, have spent enormous amounts in acquiring property, razing buildings and excavating rock and other difficult materials to obtain such auxiliary ports, which are here immediately available. The tracts can be reclaimed by filling the higher ground with material dredged from the lower ground and inlets, in the manner in which much has already been done at Port Newark Terminal. Lateral canals can be carried inshore the full widths of the tracts, and the unrestricted areas offer the large company and the small whatever it needs in the way of piers, quays, warehouses and factory buildings, all accessible to rail, water and highway transportation. Jamaica Bay, Flushing

Bay, Newark Bay, the Hackensack Meadows, both the Staten Island and New Jersey shores of the Arthur Kill and the shores of the Raritan River all invite this kind of development.

Still another type is suggested by the rather precipitous shores of the Hudson north of the highly developed tracts. Here the width and depth of the river, the extent of the undeveloped waterfront, the difficulty of competing with more central sections of the Port for ordinary rail-to-ship and ship-to-rail commerce, all suggest quay developments for industrial plants, particularly those that can receive their raw materials from or deliver their finished products to ships alongside their plants. A number of such plants are already found at Yonkers, Edgewater and the other river communities.

Channel Improvement

The Federal Government has under contract or has authorized channel improvements in almost every part of the Port. Yet when all are completed the Port will not be adequately served, in the estimation of the Commission. Although New York Harbor handles about half of the foreign commerce of the country, less than three per cent of all Federal appropriations for river and harbor improvements have been expended in this harbor.

The projects already authorized should be expedited. The Commission would further urge upon the Federal authorities that the lower Hudson be dredged from pierhead line to pierhead line to make the waterfront accessible to the deepest cargo carriers; that the Federal Government co-operate with the local authorities in providing 30-foot entrance channels to Jamaica Bay and Newark Bay and deep-water channels within those bays, a deeper channel than present projects provide through the Raritan Bay as well as up the Raritan River, to serve a possible terminus of the proposed belt line along that river, and a deeper channel up the Passaic River to Passaic and ultimately to Paterson; and that it also co-operate in the improvement of the Harlem River, by the removal of existing impediments to navigation, consisting of the low drawbridge of the New York Central Railroad at Spuyten Duyvil, the "U" bend in the ship canal around Johnson's Iron Works, the midstream piers of High Bridge and the shoal water through the Bronx Kills. The latter subject has lately been considered by a commission created by Chapter 586 of the Laws of New York, 1919, known as the Harlem River Conference Board, whose recommendations fully meet this situation and should be carried out. The New York Central bridge at Spuyten Duyvil will be eliminated if the amplified automatic-electric plan recommended by the Commission is adopted.

The bridges over Newark Bay should be replaced, if feasible, by tunnels, otherwise by higher bridges with wider draws and longer and fewer fixed spans. The contemplated highway bridge, when built, should be of such location and design as not to add further impediments to navigation.

Efforts should be made to consolidate some of the numerous bridges across the Hackensack River.

All of the recommended movements for Federal aid and assistance within the Port would undoubtedly bring results sooner if the two States were united and presented the joint views of both States through a central authority This is another and important reason for not delaying consummation of the compact between the two States.

Highway Accessibility

Of the three forms of accessibility — rail, water and highway — essential to every successful waterfront development, highway access is the most difficult to prescribe in advance of the detailed design of the development. The highways and driveways in the immediate vicinity of the development are details themselves, to be worked out in consonance with the rest of the design.

Highway communication between different sections of the Port is a part of the problem, however, and one to which the Port Authority can well give attention. The main thoroughfares must be adequate, as in present instances they often are not, to carry the truck traffic the developments will induce. Where waterways intervene means of crossing them must be found, and this will naturally lead to the consideration of ferries, vehicular tunnels and bridges. Crossing the majority of the wider waters of the Port by any of these means usually involves at least two municipalities directly, while other municipalities more remote from the waters may be prospective beneficiaries of the contemplated improvement. Therefore provision of suitable highway access to the different sections of the Port becomes a problem, and an important one, for a joint agency such as the Port Authority.

New York Barge Canal and Its Terminals

The third year of operation of the enlarged New York State canal system, known as the Barge Canal, has just ended. Because of the incomplete state of parts of the canal and many of its terminals throughout its length, the shortage of barge equipment suited to the enlarged waterway, and the abnormal traffic conditions caused by the war, the future possibilities of the canal are not yet ascertainable. The Commission is of the belief that the canal system will be a large factor in the future operations of the Port.

Eight canal terminals have been or are being built in the Port District. The principal one at present is at Piers 5 and 6, Coenties Slip, East River, Manhattan. A deep-water terminal is being built at Gowanus Bay, Brooklyn, where the State has authorized and begun the construction of a much needed grain elevator. A terminal will be required at once at Piermont, the north terminus of the proposed outer belt line, and the Commission believes other terminals will be needed — one or two on the lower west side of Manhattan (projected but not built) and one or two on the New Jersey shore. Naturally, those on the New Jersey shore could not be built as part of the New York State canal system, but other means can be found if the traffic warrants.

Other Canals Affecting the Port

Other canals existing and projected will have considerable bearing on the commerce of the Port. Within the Port District a much needed waterway is the Gravesend Bay-Jamaica Bay Canal recommended recently by the Board of Conference created by the New York Legislature to study the question. This canal is needed to provide a sheltered and safe passage for barges from the inner harbor to Jamaica Bay.

Three canals outside of the Port District but of great importance are the New Jersey Ship Canal, under consideration but not yet built, from Raritan Bay to the Delaware River; the Cape Cod Canal crossing the base of Cape Cod, and the Chesapeake & Delaware Canal connecting the Chesapeake and Delaware Bays. The Commission urges the early construction of the New Jersey Ship Canal and the improvement of the other two as contemplated to make them serviceable as parts of the projected Intracoastal Waterway from Maine to Florida.

Freight-Handling Machinery

New York is criticised as being woefully deficient in the matter of machinery for transferring cargo. The Commission has made an extensive study of the subject from many angles. It has not found the Port as deficient as the critics charge, nor can it look upon abundance of machinery as a cure-all. It is useless to speed up one operation if the other operations cannot keep the pace, and useless to attempt a general specification for freight-handling machinery.

Wharf cranes can be utilized to great advantage under some—not all—conditions, and new piers should in the main be designed to carry cranes. Tractors and trailers to get the goods promptly to and from the ship's side are equally important—and neither class of machinery is of much value if warehouse space is not at hand to relieve the wharf shed of storage duty.

Special machinery for large quantities of single commodities in uniform packages can save much time.

Freight-handling machinery, even though it may while at work save time and money, is not always justifiable if it is to be idle much of the time. On the other hand, the investment in the ship is so large by comparison with the cost of wharf machinery that the idle time of the machinery may become of secondary importance to the saving of time to the ship.

Handling of Special Commodities

Besides foodstuffs, to which attention has already been given in this report, there are a number of other special commodities that come to the Port in large quantities and require special facilities.

Fuel — More than half by weight of all freight brought to the Port by rail is fuel, principally coal. Much of it is consumed locally, much is carried through by rail, much is reshipped to New England in barges and much is placed in the bunkers of ships.

In the main the Commission believes the existing facilities and methods are satisfactory. A central bunkering plant is recommended for such ships as are idle in port long enough to take advantage of the lower cost of obtaining fuel than by the present method of coaling at the berth from barges, and in connection with the bunkering plant there should be more storage provided for emergencies. It is also recommended that the large public utility companies in New York consider gradually relocating their power plants along the rails in New Jersey and transmitting their power under the Hudson by cable, thereby eliminating the costly water delivery.

Grain — New York has active competitors from Montreal to Galveston for the export grain trade of North America. Some of the rival ports have grain-handling facilities superior to those at New York, and New York has until recently made little effort to develop the full grain-carrying possibilities of the Barge Canal. The elevator the State has recently begun at Gowanus Bay, Brooklyn, should give the canal the opportunity it has heretofore lacked. Elevators should also be built at the north and south ends of the outer belt line, accessible to all of the New Jersey railroads and the Barge Canal on equal terms.

Building Materials — Building materials—sand, stone, brick, cement, lumber, steel and other products—must necessarily come to the Port District in large quantities to supply the local demand. A large percentage of them come via Hudson River barges, while considerable quantities of brick come by barges from the Raritan River section.

Only haphazard facilities in the way of open piers and machinery for unloading the barges are available. Along the lower west side of Manhattan no pier is available for this use, though scant opportunity is afforded at a few open bulkheads. The future organization of the waterfront should provide at more regular intervals piers suitable for receiving building materials, together with machinery to facilitate handling them.

Zoning of Steamship Service by Trade Routes

Under the present divided control of the Port of New York neither a zoning system by trade routes nor the possibility of establishing one exists. Zoning by commodities, so far as it obtains, is sporadic and the result of necessity rather than policy.

Such piers as are under public control are leased for various terms to individual steamship companies without regard to their destinations, or the convenience of their patrons. Various evils arise from this source; congestion on land and water and destructive competition for the most favored sites are the principal ones.

If all of the vessels plying, for example, between New York and Africa docked in one locality where access by rail and dray were on an equal basis, it is apparent that no patron would be led to favor any particular line on account of preferential location or facilities.

Another and not unimportant argument for zoning lies in the fact that it would simplify the question of mechanical equipment on piers. Undoubtedly the character of the freight on some of the trade routes is such that it could more easily be handled by mechanical means than could that on other routes, and the piers for such zones could be equipped with the most modern machinery without fear that the volume and character of freight would make the installation an economic mistake.

The Commission favors zoning by trade routes and believes that substantial benefits would result from it, and that it could be readily established by a Port Authority such as the Commission recommends.

Dry Docks and Marine Repair Plants

There are about twenty companies within the Port District that offer marine repair facilities—dry docks, floating docks or marine railways. In all these comprise about fifty dry docks and floating docks, and a number of marine railways. About half of the plants are located in Brooklyn. The others are practically all in Manhattan, the Bronx, Hoboken and Jersey City.

The largest commercial dry dock in the harbor is a graving dock located in the Erie Basin, Brooklyn. It is 620 ft. long, 85 ft. wide and 25 ft. deep over the keel blocks. This is inadequate to handle many of the vessels entering the Port, and the general run of the facilities are much smaller, being adapted to harbor craft and pleasure yachts, but not to ships of any size.

The largest graving dock in the harbor is at the New York Navy Yard on Wallabout Basin, East River, Brooklyn. It is 694 ft. 9 in. long, 139 ft. 6 in. wide at the coping, 112 ft. wide at the tops of the keel blocks and 32 ft. 11½ in. deep over the keel blocks. Thus it is capable of docking considerably larger vessels than any of the private docks. The Port should not be dependent, however, upon the facilities of the United States Navy in this respect. There should be within the District at least one commercial dry dock capable of handling the largest ships afloat. There should also be a wider distribution of the facilities for smaller craft.

Harbor Pollution

Pollution of the waters of the harbor is a matter that needs attention. Because of the increasing use of oil as fuel and the added activities of manufacturing plants in the Port District, pollution by oil and other injurious substances is a growing menace to waterfront structures and shipping, and to the bathing beaches. Pollution by garbage and sewage also touches the public health.

Pollution cannot well be prevented or regulated by the independent action of forty municipalities. Uniform legislation by both States and by Congress is required. The Commission makes no specific recommendation upon this subject because of the present litigation over the disposal of Passaic valley sewage; but believes the Port Authority should be vested with jurisdiction over all forms of harbor pollution.

Incidental Studies

To reach its conclusions the Commission and its staff have made extended studies of other elements of the port problem than those specifically discussed in the foregoing pages. Three of the most important of these are trucking, warehousing and ferry operations as conducted at present. Others are the vehicular tunnels of the future, the methods of handling ice and of disposing of municipal waste, the available electric power supply of the Port, the present and future sources of water supply.

Free Ports

The question of the establishment in this country of " free ports " or what might better be termed " foreign trade zones " is one that has been under discussion for a number of years.

The creation of a district or zone outside of the customs limits where foreign goods may be brought, assembled, manipulated, manufactured and re-exported, without the necessity of paying any tariff charges, has resulted in material benefit to many seaport cities abroad, and successful free ports have been established at Hamburg, Copenhagen and other leading European ports. Studies have been made by commercial interests in New York of the operation of free ports abroad with a view to determining the feasibility of establishing a free port zone or zones within the Port of New York. Legislation has been introduced in Congress looking toward the establishment of free ports in this country. Investigations have been made by Federal boards to determine the sentiment in this country toward the free port project, and as a result a program for legislation has been developed.

This Commission has appeared before the congressional committee having this free port matter under consideration and has expressed itself in favor of the policy of establishing the free port principle at the Port of New York. It believes, however, that the provision in the bill under consideration which limits the number of free port zones within any port district to one should be eliminated and that the bill should be so amended that the free port district or districts created within the Port of New York should be under the jurisdiction of the Port Authority which this Commission is recommending.

Protection in Case of War

One of the duties imposed upon the Commission is the " working out of a comprehensive and adequate interstate and Federal Port policy to meet commercial needs in times of peace and the protection of the harbor and adjacent localities in times of war."

The defensive protection of the Metropolitan District is essentially a military problem, the solution of which devolves upon the Federal Government, and the Commission does not consider itself competent to offer one. New methods of attack were developed during the world war not considered when the existing protection of the Port was devised, and for which adequate defence must be provided if the harbor is to be properly defended against an active enemy. The Commission believes, however, that in the area embraced within the Metropolitan District suitable and available sites can be found for all of the elements that may be considered essential: Sea coast and land batteries, navy yards, submarine bases, aviation fields and anti-aircraft batteries.

The belt-line railroad system recommended by the Commission might prove of tremendous value in case of war. It would make possible quick shifts of troops and supplies from one part of the Port District to another if the Port was under attack, while in the unhappy event of a successful attack from the sea and hostile occupancy of the waterfront, the outer belt line would be sufficiently removed from the enemy to constitute a valuable medium for the concentration of forces resisting further invasion.

When our troops were sent overseas shortly after the United States entered the war, supplies were rushed to the Port in such quantities as to produce congestion, which not only delayed the transports but also resulted in their carrying only partial loads — and this at a time when the need for shipping was so great. This condition and the accompanying confusion were due primarily to a lack of proper organization of the Port. There was no co-ordination of the existing terminal facilities, no unified control of any of the other elements of the harbor — piers, storage facilities, tugs, floats and lighters. Incidentally, it may be remarked that this condition existed at all of the ports of the Atlantic coast, but it was especially noticeable at the Port of New York because of the vast amount of supplies that were shipped to it and that originated within its limits.

The Federal authorities took over the railroads and thereby provided a way for co-ordinating the terminal situation. The Commission, recognizing the necessity for unifying the various parts and elements of the Port, succeeded in having created the War Board for the Port of New York, from which, in conjunction with the Railroad Administration, grew an organization and control of the harbor which eliminated confusion and congestion, so that ultimately New York handled more than its share of the overseas transports, both troop and freight.

In other words, the Port did not function in time of war, nor could it do so efficiently, until an adequate port authority was established. The Commission again emphasizes the necessity for such an authority and for the adoption of the compact between the States of New York and New Jersey which will make possible its creation. Such an instrumentality will meet the commercial needs in times of peace and will assist the Federal authorities in giving proper protection in times of war.

Policy and Legal Plan

In whatever direction the Commission turned when it undertook this investigation, it was confronted by one overshadowing fact — the absence of port organization. On one side, Greater New York, with its large port development, overshadowing a number of smaller communities; on the other, forty municipalities, all dependent for their best development upon some coherent, well-managed and co-ordinated system, yet all working to different ends, with no agency for co-operation.

The legislation creating this Commission implicitly recognized the necessity for joint action by both the States, and though two Commissions were created, they promptly became one for the purpose of finding a common working basis. The actual experience of this Commission is a practical illustration of what is required. The Commission has been a student body. It has been also a real co-operative agency. For the first time in their history these various communities have been brought together in the consideration and study of a common task. The States of New York and New Jersey have sat at the same table, studied the needs of the Port District as an entirety, secured the necessary information jointly, and now present it, as the property of both States (paid for in equal contributions by each) with a suggested solution to be accepted by both States. It is clear now that no adequate physical solution for the service of the Port can be found which does not involve co-operation between the two States.

Some forecast of the immediate danger, however, is to be found in the experience of the New York Bay Pollution Commission, which, in 1905, recommended the creation of a Port District and a joint agency of the two States for the purpose of preventing harbor pollution. Nothing came of that report. Instead, New York and New Jersey are now in litigation before the United States Supreme Court over this subject. The excellent and valuable scientific piece of work produced by that Commission has brought about no practical results.

With that experience in mind, this Commission feared lest such a misfortune might be repeated with even greater damage to the future interest of the two States. It realized that the obligations of the two States expressed in the legislation creating the Commission must be made explicit, definite, certain and adequate, if the co-operation thus began was to continue. The task is a common task. The work must be carried on continuously. New experience, new information will be required. What agency is to acquire this experience and this information? What authority is to develop and exercise continuity of policy?

What is the first step? Obviously, to overcome the legal barrier, to bind the two States in the common purpose. This can be accomplished by a compact or agreement. The lesson of the vehicular tunnel is in point. This will be the first real highway connection between New York and New Jersey. Yet it could not be built except under and by virtue of an agreement between the two States.

The Commission is very clear — indeed, was clear before it had completed its study — that a firm, resolute and definite understanding should be arrived at between the two States commensurate with the duty involved and with the opportunities presented. Articles I and II of the proposed compact between the two States recognize this. The recitals preceding these articles are expressive of the determination implied in the legislation creating the Commission. If such a compact is entered into, the agreement between the two States will be more than a pledge. It will define and bound a district in which the two States will actually co-operate. Moreover, it will create an agency to bring about results.

Spurred by the example of other ports, the Commission in its Progress Report in 1919 recommended the creation of a Port Authority with adequate powers to carry out a comprehensive plan when adopted by the Legislatures of the two States. This proposal met with considerable opposition, chiefly from the municipal authorities of the City of New York, who, proud of its accomplishment and jealous of its prestige, did not yet perceive the benefits possible through co-operation with the communities on the west, nor admit a joint responsibility with them in the heritage of these great natural resources.

Such a Port Authority as was proposed would have been more akin to the central port authorities of other great ports of the world, among which are London, Liverpool, Montreal, San Francisco and New Orleans.

But not enough people seemed to understand or to be impressed with the importance of the proposal; necessity had not yet pressed us to that point; and there seemed a danger that the opportunity for co-operation between the two States might be lost through the opposition of some of the local communities, springing from the fear that they might lose something of their own power or prerogatives.

Accordingly, in co-operation with the leaders of the Legislatures of both States and of both political parties in each State, the Attorneys General of both States and the Corporation Counsel of the City of New York, the Commission finally deferred to the opinion of the conferees who had come to an agreement upon a grant of power to the " New York Port Authority " which would provide an agency to carry forward the great work and yet leave the local authorities with large freedom.

If the Legislatures in their wisdom should now determine to restore some of the powers originally proposed and remove some of the limitations that compromises then entailed, the Commission believes a more efficient Port Authority would result.

Through such an agency all the communities of the Port will find new power and benefit in co-operation, of which all are in immediate need. All are now greatly limited by constitution or statute in their power to borrow capital for port and terminal developments. This inhibition can be overcome by the Port Authority, for if, as the Commission finds, many of the great developments contemplated and recommended in its report are so needed and so clearly profitable in their ultimate results as to justify investment of the necessary capital, the Port Authority as a body corporate and politic may issue its own debentures secured by revenues to be derived from the property it acquires and operates itself or under lease.

The rapid growth of the Port will surely continue, and there will doubtless be new problems that will tax the judgment and ingenuity of any port authority. But time has eliminated some of the problems of the past century. Railroads and steamships are no longer an experiment. Bridges have been built across the East River and can be built across the Hudson if warranted. Tunnels can be built under any waters in the harbor. Machinery undreamed of in 1820, 1850 and 1880 is found today at many points. Again, the traffic has grown to such proportions that expenditures inconceivable in the earlier days can now be amply justified. Thanks to the advance of science it is entirely possible — but possible only if there is unified and rationally directed effort through joint administration of the district — to keep pace with the growth of the Port.

If the comprehensive plan recommended by the Commission is approved by both States, that approval will immediately necessitate establishing a relationship between the States and creating a joint agency to carry out and effectuate the plan. Congressional assent and assistance will also be needed. This can be more easily obtained if both States are represented by a common agency. The co-operation of many communities and municipalities within the Port District will also be required, and this co-operation likewise can best be secured through a common agency.

On the other hand, if the recommendations of this Commission are not immediately approved, who is to take up the study and carry it forward, improve it in the light of criticism and of greater knowledge and more information? If this report is received by the Legislatures of both States, the Commissioners will be discharged from further performance of their duties. There will be no common relationship between the two States, no agreement between them and no agency to carry forward the work of port development.

The Commission concludes now, as it did two years ago, that no matter what physical plan may be agreed upon between the two States, however it may be worked out in detail, the compact between the two States agreeing to co-operate, defining the territorial limits of the District and creating a Port Authority with powers to go forward is absolutely necessary.

Conclusion and Recommendations

The Commission had before it three definite tasks — first, to get the facts; second, on the basis of an analysis of these facts to lay out a better physical plan of organization of the Port; and third, to work out a legal plan for the accomplishment of the result.

The facts have now been ascertained and are set forth in the chapters following this report. The physical or " comprehensive " plan is based upon these facts. The soundness of the Commission's recommendations with regard to the physical plans can be determined only by a careful application of all of these facts.

The physical and political geography of the Port, the diversity of its activities, its very bigness have created problems not present elsewhere. How can the natural land and water facilities be most fully utilized and co-ordinated? How can the high cost of terminal operations be materially reduced? And the delays? How can the conflicting demands of important enterprises for valuable waterfront be met? How can a plan be evolved comprehensive enough to satisfy and foster the development on the one hand of the metropolis of the hemisphere, its five boroughs and its adjoining communities, and on the other hand such thriving cities as Newark and Jersey City and some forty other municipalities, each with its own local pride, ambition and needs for development? Apart from the demands of industry and commerce, how can the eight million persons living within the Port District be fed, clothed and housed? And if the physical plan to accomplish all of these things is at hand, how can it be put into execution?

It is the hope of the Commission that it has found satisfactory answers to all of these questions. They are found, it is believed, in the following epitomized recommendations of the Commission:

1. Adoption of a compact between the States of New York and New Jersey providing for
    - (a) Creation of a single Port District;
    - (b) Administration by a single Port Authority.

2. Construction of the automatic-electric system with many joint terminal stations in Manhattan for the distribution and collection of general merchandise freight and food products.

3. Development of a standard belt-line railroad system for all parts of the Port except Manhattan, embracing

    (a) Inner or waterfront belt lines in New York and New Jersey;
    (b) Middle belt lines in New York and New Jersey;
    (c) An outer belt line in New Jersey.

4. Consolidation of railroad marine operations not eliminated by the automatic-electric and extended rail service, with separate joint railhead terminals for

    (a) Car-float service;
    (b) Lighterage.

Recommendations Nos. 2, 3 and 4 make up the comprehensive physical plan, the improved railroad-terminal system which will be the backbone of a rational port development, and the formal adoption of which in conjunction with the compact the Commission urges upon the Legislatures. The economic sequence of construction should be determined by the Port Authority.

In furtherance of that rational development, though not as a part of the official plan, the Commission recommends the following:

5. Construction of food receiving stations and inauguration of a system of inspection and certification at the railroad joint yards, which would make possible the creation of terminal markets around stations of the automatic-electric system in Manhattan and the Bronx.

6. Reorganization with wider piers and slips and more warehouse facilities of the Manhattan and other congested waterfronts.

7. Dredging of channels to every part of the Port's waterfront in keeping with the volume and character of the water-borne commerce seeking to use them, and removal or modification of bridges obstructing the channels.

8. Provision of suitable highway access to every part of the Port's waterfront.

9. Construction of additional terminals for the New York Barge Canal.

10. Wider installation of judiciously selected freight-handling machinery.

11. Creation of bunkering facilities and fuel reserves for steamships.

12. Erection of grain elevators for joint use of New Jersey railroads and New York Barge Canal at a southern terminus of the outer belt line and at Piermont, and early completion of the Barge Canal elevator authorized at Gowanus Bay.

13. Provision of better facilities for handling building materials.

14. Zoning of steamship terminals by trade routes as far as practicable.

15. Establishment of free ports in the Port District.

16. Obtaining of immediate partial relief from present oppressive terminal conditions through

(a) Consolidation of marine equipment and service;

(b) Inauguration of voluntary store-door delivery by an organized motor-truck medium.

Respectfully submitted,

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PART II

CHAPTER I

History and Purpose of the Commission and Organization of the Work

This Commission is the natural and logical outcome of historical factors of great importance, and quite apart from the necessity for considering these historical factors as a background for present and immediate action, the historian of the future will examine the work of the Commission in the light of the historical perspective.

Early Commercial Relations Between New York and New Jersey

For a long time prior to 1833, New York and New Jersey had been in controversy concerning the boundary line between the two States; New York contending that the boundary line was at low water mark on the westerly side of the waters between the two states and New Jersey claiming, on the other hand, that the center line of these waters was the general boundary. In 1830, New York passed an act, in which it set forth its claim to low water mark on the Jersey side. It based its claim upon possessions "both before and after the Revolution" and upon the technical interpretation of the grant from the Duke of York to Lord Berkeley and Sir George Carteret in 1664. The New Jersey claim was also based on the grant of the Duke of York.

This controversy was aggravated by another.

We read in McMaster's "History of the People of the United States," that Robert R. Livingston became interested in steam navigation and, confident of success, obtained from the legislature of New York, in 1798, a grant of the exclusive right to navigate the waters of New York State by steam, upon condition that he should, within one year, move a boat of twenty tons by steam at the rate of four miles an hour. He failed to do so, but the work went on, and when in 1801, Jefferson sent him as Minister to France, he was still engaged in experimenting.[1] Still confident of steamboat navigation, Livingston obtained another grant from the New York legislature in 1803. The monopoly which, in 1798, had been given conditionally to Livingston was now extended to Fulton and Livingston, (Fulton having, in the meantime, completed his experiments), with the understanding, that they would, within two years, by means of steam, move a twenty-ton boat four miles an hour against the current of the Hudson.[2]

In 1803, the Clermont was built and launched on the East river. She traversed the one hundred and fifty miles between New York and Albany in thirty-two hours, and thus won for her owners the sole right to use steam on the lakes and rivers of New York State for twenty years to come. Her name was changed to the "North River," and with the return of spring, "she began to run regularly up and down the Hudson." The legislature confirmed and extended the monopoly, and from 1808 the steamboat came slowly, but steadily, into general use. The summer of 1809 saw one on Lake Champlain, another on the Raritan, and a third on the Delaware.[3] This latter was the famous Phoenix, built by John Cox Stevens at Hoboken in 1808. It was planned to operate it as a passenger boat between New Brunswick and New York. The monopoly held by Fulton and Livingston prevented the vessel from entering the waters subject to the jurisdiction of New York State, and Stevens, sending her by sea to the Delaware, ran her between Philadelphia and Trenton.

In 1810, the Raritan and the Phoenix ran in connection with each other as parts of one route. It was then possible, "at a cost of five dollars in money and twenty-six hours in time," to traverse thrice a week the ninety miles which separate Philadelphia from New York."[4] (This distance is now passed over ninety times a day by the passenger trains of the Pennsylvania Railroad in two hours.)

It is interesting to observe that the profits of the Raritan trade, twelve shillings for each passenger, went to the "Fulton and Livingston Steamboat Company" and this McMaster says "provoked the wrath of the people of New Jersey" and resulted in a bold attack in the next legislature upon the monopoly of Fulton and Livingston. "The demand was made that if the citizens of New Jersey could not build a steamboat and send it across the Hudson to New York without leave of Fulton and Livingston, then no boat having the license of Fulton should enter the waters of New Jersey." The legislature of New Jersey did not go so far as this. "New York in her law provided that if anybody should navigate a steamboat within her jurisdiction without a license, the parties aggrieved might seize the boat, engine, tackle and apparel. Citing this, New Jersey ordered that if anybody did seize such a boat belonging to a citizen of New Jersey, and lying on the waters between the two States, the owners might seize, in return, any boat belonging to any citizen of New York found in any waters of New Jersey."[5]

"The New York company then threatened to withdraw their boat, place it on the Sound, grant no licenses to run steamboats to New Jersey, stop the ferry at Paulus Hook and ruin New Brunswick."[6] (Here is the explanation of the growth of New Brunswick. En route to New York, it was the place at which the New York boats landed and enabled connection to be made with Philadelphia. If the connection by ferry were cut off, New Brunswick would perish.) Fortunately, the threats made at this time were never carried out. The New York company had trouble enough without seeking more. "A rival sprang up and a boat called the Hope was soon running between New York and Albany without a license."[7] Fulton and Livingston promptly applied to Chancellor Lansing for an injunction. The application was heard at the October term, 1811, of the Court of Chancery, and was denied. Livingston and Fulton appealed to the Court of Errors, which reversed the decision, held that the act was constitutional and granted the injunction.[8] But the Supreme Court of the United States reversed the Court of Errors in the great case of Gibbons v. Ogden, holding that the New York legislature had no power to grant a monopoly upon navigable waters.[9]

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[1] McMaster's "History of the People of the United States," Vol. III, p. 488.

[2] Idem, p. 489.

[3] Idem, pp. 489–90.

[4] Idem, pp. 490–1

[5] Idem, pp. 492–3.

[6] Idem, pp. 492–3.

In 1826, the deputy sheriff of Richmond county, New York, was arrested and indicted by the New Jersey authorities for serving process within the jurisdiction of New Jersey.

In 1828, Governor Williamson of New Jersey addressed a communication to the Legislative Council and General Assembly, summarizing the history of the boundary dispute between New York and New Jersey, in which he stated that at various times in 1806, 1811 and 1824, New Jersey had formally addressed the legislature of New York to put an end to the dispute. In 1833, Governor Marcy of New York wrote Governor Southard of New Jersey expressing his regrets over the unfortunate controversy between the two states, and in 1833 an act was passed giving the Governor of New York the power to appoint three commissioners. In the same year a corresponding act was passed in New Jersey.

The result of the labors of this commission was the passing of two acts in 1834,[10] by which the boundary line between the two states was fixed substantially at the middle of the river, of the Bay of New York, of the waters between Staten Island and New Jersey, and of Raritan Bay, to the main sea; but New York "shall have and enjoy exclusive jurisdiction of and over all waters of the Bay of New York, and of and over all the waters of Hudson River, lying west of Manhattan Island, and to the south of the mouth of Spuyten Duyvil Creek, and of and over the lands covered by the said waters to the low water mark on the westerly or New Jersey side thereof," while New Jersey "shall have the exclusive right of property in and to the land under water, lying west of the middle of the Bay of New York and west of the middle of that part of the Hudson River, which lies between Manhattan Island and New Jersey * * * " and "shall have the exclusive jurisdiction of and over the wharves, docks and improvements made and to be made on the shore of the said state, and of and over all vessels aground on said shore, or fastened to any such wharf or dock; except that the said vessels shall be subject to the quarantine or health laws, and laws in relation to passengers, of the State of New York, which now exist or which may hereafter be passed."

The names of the New Jersey commissioners were:
Hon. Theodore Frelinghuysen
James Parker
Lucius Q. C. Elmer

and the names of the New York commissioners were:
Benjamin F. Butler
Peter A. Jay
Henry Seymour.

The Treaty is very brief. It is as follows:

Article I. The boundary line between the two states of New York and New Jersey, from a point in the middle of Hudson River, opposite the point on the west shore thereof, in the forty-first degree of north latitude, as heretofore ascertained and marked, to the main sea, shall be the middle of the said river, of the bay of New York, of the waters between Staten Island and New Jersey, and of Raritan Bay, to the main sea, except as hereinafter otherwise particularly mentioned.

Article II. The state of New York shall retain the present jurisdiction of and over Bedlow's and Ellis' Islands, and shall also retain exclusive jurisdiction of and over the other islands lying in the waters above mentioned, and now under the jurisdiction of that State.

Article III. The state of New York shall have and enjoy exclusive jurisdiction of and over all the waters of the Bay of New York, and of and over all the waters of Hudson River, lying west of Manhattan Island, and to the south of the mouth of Spuyten Duyvil Creek, and of and over the lands covered by the said waters to the low water mark on the westerly or New Jersey side thereof; subject to the following rights of property and of jurisdiction of the state of New Jersey, that is to say:

1. The state of New Jersey shall have the exclusive right of property in and to the land under water, lying west of the middle of the bay of New York and west of the middle of that part of the Hudson River, which lies between Manhattan Island and New Jersey.

2. The state of New Jersey shall have the exclusive jurisdiction of and over the wharves, docks and improvements made and to be made on the shore of the said state, and of and over all vessels aground on said shore, or fastened to any such wharf or dock; except that the said vessels shall be subject to the quarantine or health laws, and laws in relation to passengers, of the state of New York, which now exist or which may hereafter be passed.

3. The state of New Jersey shall have the exclusive right of regulating the fisheries on the westerly side of the middle of the said waters; *Provided,* that the navigation be not obstructed or hindered.

Article IV. The state of New York shall have exclusive jurisdiction of and over the waters of the Kill Van Kull, between Staten Island and New Jersey, to the westernmost end of Shooter's Island, in respect to such quarantine laws and laws relating to passengers as now exist or may hereafter be passed under the authority of that state, and for executing the same; and the said state shall also have exclusive jurisdiction, for the like purposes, of and over the waters of the Sound, from the westernmost end of Shooter's Island to Woodbridge Creek, as to all vessels bound to any port in the said state of New York.

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[7] McMaster's "History of the People of the United States," Vol. III, p. 493.

[8] Robert R. Livingston and Robert Fulton v. James V. Ingen, H. Boyd and twenty others, 9 Johns. 507.

[9] 9 Wheat. 1; 6 L. ed., 23; see below Gibbons v. Ogden, 17 Johns. (N. Y.) 488. This case was instituted by the assignees of the Fulton Steamboat Company for the purpose of restraining the defendant from navigating with his steamboats the waters between the City of New York and any part of Staten Island, or of the shores of New Jersey south of Powles-Hook Ferry.

[10] These two acts were passed by the legislature of New York (Chapter 8, Laws of New York, 1834) and by the legislature of New Jersey (Laws of New Jersey, 1833–34, p. 118) and confirmed by the Congress of the United States June 28, 1834 (U. S. 23, Cong. 1 Sess. Sen. Doc. No. 239).

Article V. The state of New Jersey shall have and enjoy exclusive jurisdiction of and over all the waters of the Sound between Staten Island and New Jersey, lying south of Woodbridge Creek and of and over all the water of Raritan Bay, lying westward of the line drawn from the lighthouse at Prince's Bay, to the mouth of Mattavan Creek, subject to the following rights of property and of jurisdiction of the State of New York:

1. The state of New York shall have the exclusive right of property in and to the land under water, lying between the middle of the said waters and Staten Island.
2. The state of New York shall have the exclusive jurisdiction of and over the wharves, docks and improvements made and to be made, on the shore of Staten Island; and of and over all vessels aground on said shore, or fastened to any such wharf or dock, except that the said vessels shall be subject to the quarantine or health laws, and laws in relation to passengers of the state of New Jersey, which now exists or which may hereafter be passed.
3. The state of New York shall have the exclusive right of regulating the fisheries between the shore of Staten Island and the middle of the said waters, provided that the navigation of the said waters be not obstructed or hindered.

Article VI. Criminal process issued under the authority of the state of New Jersey, against any person accused of an offense committed within that state, or committed on board of any vessel being under the exclusive jurisdiction of that state as aforesaid, or committed against the regulations made, or to be made, by that state in relation to the fisheries mentioned in the third article; and also civil process issued under the authority of the state of New Jersey, against any person domiciled in that state, or against property taken out of that state to evade the laws thereof; may be served upon any of the said waters within the exclusive jurisdiction of the state of New York, unless such person or property shall be on board a vessel aground upon, or fastened to the shore of the state of New York, or fastened to a wharf adjoining thereto; or unless such person shall be under arrest, or such property shall be under seizure, by virtue of process or authority of the state of New York.

Article VII. Criminal process issued under the authority of the state of New York, against any person accused of an offense committed within that state, or committed on board of any vessel being under the exclusive jurisdiction of that state as aforesaid; or committed against the regulations made or to be made by that state, in relation to the fisheries mentioned in the fifth article; and also civil process issued under the authority of the state of New York, against any person domiciled in that state, or against property taken out of that state to evade the laws thereof; may be served upon any of the said waters within the exclusive jurisdiction of the state of New Jersey, unless such person or property shall be on board a vessel aground upon, or fastened to, the shore of the state of New Jersey, or fastened to a wharf adjoining thereto, or unless such person shall be under arrest, or such property shall be under seizure, by virtue of process or authority of the state of New Jersey.

Article VIII. This agreement shall become binding on the two states when confirmed by the legislatures thereof respectively, and when approved by the Congress of the United States.

THE PURPOSE AND MEANING OF THE TREATY

The treaty has been frequently passed upon by the courts both of New York and New Jersey. In *State v. Babcock,* 1 Vroom 29, the New Jersey Court held that an indictment for a nuisance by placing wrecks in the Hudson River below low water mark on the New Jersey shore would not lie in the State of New Jersey, upon the ground that by the compact of 1834 exclusive jurisdiction over offences in or upon the water or lands under them resided in the State of New York. In *Central Railroad of New Jersey v. Jersey City,* 41 Vroom 81, Judge Garrison quotes with approval (p. 96) the statement of Judge Andrews of the New York Court of Appeals as follows: "The purpose of vesting exclusive jurisdiction over these waters in the state of New York was to promote the interests of commerce and navigation, which would, as supposed, be best subserved by giving to this state the exclusive control and regulation of the waters of the bay and harbor of New York." Judge Garrison held that what was granted over these waters was not "sovereignty" but jurisdiction as "distinct from sovereignty" and that in consequence the power to tax the property under water still remained with New Jersey. On appeal to the United States Supreme Court (209 U. S. 472), decided April 27, 1908, Justice Holmes delivered the opinion, saying (p. 479): "But we agree with the state courts that have been called on to construe that part of the agreement, that the purpose was to promote the interests of commerce and navigation, not to take back the sovereignty that otherwise was the consequence of article 1. This is the view of the New York as well as of the New Jersey court of errors and appeals, and it would be a strange result if this court should be driven to a different conclusion from that reached by both the parties concerned."

Judge Elmer, reviewing the history resulting in the Treaty of 1834, says in *State v. Babcock,* 1 Vroom 29, pp. 33 and 34:

"When the commissioners of New Jersey and New York again met, in 1833, and it was found that those of the latter state appeared to be desirous of arranging the dispute upon fair and liberal terms, but deemed it indispensable that their great commercial emporium should have the exclusive control of the police on the surrounding waters, and full power to establish such quarantine regulations as should be found necessary, the commissioners of this state deemed it wise to secure the exclusive property in the soil to the middle of the river, and exclusive jurisdiction over the wharves, docks and other improvements made or to be made on the Jersey shore, and of the vessels fastened thereto, and the right to regulate the adjacent fisheries, leaving to New York, which was thought to be quite as much a burthen as a privilege, the exclusive jurisdiction over offences in or upon the waters or the land covered by the water outside of the low water mark. As it was thought possible that the time might come when Perth Amboy should be an important city, like exclusive jurisdiction over the adjacent waters to low water mark on Staten Island was secured to this state. Nothing has since occurred to make the propriety of this arrangement doubtful; on the contrary, there is every reason to believe that it has secured important rights to this state, which otherwise might have been lost.

"In further elucidation of this subject, it is to be noticed that the river Delaware was never within the jurisdiction either of this State or of Pennsylvania until, by the Revolution, the rights of the crown were extinguished, and each state then held to the middle. Under these circumstances, the agreement between the two states, adopted in 1783, *Nix. Dig.* 824, provided that the two states should have concurrent jurisdiction in and upon the water of that river. Of so little importance, however, was this regulation, that it was not until so lately as 1856 that any law of this state was passed providing for the punishment of offenses committed on the river."

In *People v. Central Railroad of New Jersey,* 42 N. Y. 283, at p. 295, June, 1870, Judge Smith said: "It is quite apparent, I think, that they [the Commissioners] well and wisely considered that the necessities of the case, the welfare of these states, the exigencies of commerce, and the interests of the city and port of New York in particular, in whose prosperity, as the commercial metropolis of the country, New Jersey had, in a large degree, a common interest, required that there should be a unity of control over said waters, and a single and exclusive jurisdiction exercised over them by one of the said states."

In the same case Judge Earl said:

"At the date of this agrement [1833], certain docks and wharves had already been made on the New Jersey side, and it was foreseen that others might thereafter be needed and be made. New Jersey had but little commerce and no important city or seaport upon these waters. New York City then controlled by far the largest share of the commerce of this country, and these waters were mainly important as her seaport. It was important that this port should be subject to but one state jurisdiction, and that its jurisdiction should be of the state possessing the city of New York, and having by far the largest interest in regulating, protecting and governing the port. It was clearly the intention of the commissioners, as gathered from the whole agreement, to place that port under the exclusive jurisdiction of the state of New York, so that she could control and regulate it in the interest of her great commerce and her great commercial city" (pp. 312, 313).

"At the time this agreement was made, New York was a large and flourishing commercial city, with the finest port, and destined to be one of the largest commercial emporiums in the world, while New Jersey had no commerce, no commercial port, and no brilliant commercial prospects" (p. 308).

Under an act passed in 1886, a suit was brought in the courts of New York against one Ross to recover a penalty for depositing dredgings from a slip in the city of New York into the waters of the North River. Ross and his associate, in December, 1887, dumped a scowload of material which they dredged from a slip in the city of New York into the river opposite New York City, but on the Jersey side at a point about one-quarter of a mile from the New Jersey shore. It was claimed that since the deposit had been made within the territorial limits of New Jersey, the state of New York had no jurisdiction to enact a law subjecting persons to liability for an act done within the territory of that state. The Court of Appeals held that the compact of 1834 settled the matter and gave to New York jurisdiction over such matters to low water mark on the Jersey side, Judge Andrews saying:

"The purpose of vesting exclusive jurisdiction over these waters, in the state of New York, was to promote the interests of commerce and navigation, which would, as supposed, be best subserved by giving to this state the exclusive control and regulation of the waters of the bay and harbor of New York. * * *

"The 8th section of the act of 1886 was manifestly enacted for the protection of the harbor of New York in the interest of commerce and navigation. The citizens of New York City may possibly have a greater stake in the matter than citizens in other localities, but the destruction or serious impairment of the harbor of New York would directly affect the prosperity of the state. It would impair its revenues, imperil its system of river, canal and railroad transportation, and it is not too much to say that every industrial interest, agricultural or mechanical, would feel its blighting influence." (June, 1891. *Ferguson v. Ross,* 126 N. Y. 459, at p. 463 and p. 465.)

The Growth and Development of the Metropolitan District

Just as the metropolitan district of London, or "Greater London," the world over, is known as including not merely "the city," (a small area of 673 acres on the north bank of the River Thames forming the heart of the metropolis) but twenty-eight other municipal divisions making up the administrative County of London, such as Hammersmith, Kensington, Paddington, Hempstead, St. Pancras, Islington, Stoke Newington, Poplar, Fulham, Chelsea, the City of Westminster, Stepney, St. Marylebone, Holborn, Finsbury, Shoreditch, Bethnal Green, Wandworth, Battersea, Lambeth, Southwark, Camberwell, Bermondsey, Deptford, Lewisham, Greenwich and Woolwich, and the whole of the County of Middlesex and parts of the Counties of Essex, Kent, Surrey and Hertfordshire (London's extent is 443,419 acres or nearly 693 square miles and its population seven millions and over),[11] so for census purposes the New York metropolitan district is held to include the western portion of Long Island, the Island of Manhattan, the whole of Richmond and Westchester counties and the northern or eastern section of New Jersey.

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[11] Encyclopedia Britannica, Vol. XVI, p. 938 (11th Ed.).

The Federal Census Bureau issues a compilation of what is called "The New York City Metropolitan District."[12] It takes in not only Greater New York city (comprising Bronx, Kings, New York, Queens and Richmond counties), but the whole of Westchester County (with such cities as New Rochelle, Mount Vernon and Yonkers), besides Bergen, Essex, Hudson, Middlesex, Nassau and Union Counties in New Jersey, (including such cities as Jersey City, Hoboken, Harrison, Elizabeth, Rahway, Newark, Orange, Montclair, Paterson, etc.). This district embraces 616,928 acres of territory, of which but 183,373 acres constitute the area of New York, and 433,373 acres constitute the area of the outlying territory. As defined in the census the "New York City Metropolitan District" includes in addition to the central city, fifteen cities, forty-one boroughs, two villages, seventeen towns and seventeen townships.

Lee, in his history of New Jersey, dealing with the economic status of that state during the last half of the 19th Century, writes:

"Briefly and generally stated the area of direct New York metropolitan influence comprises the counties of Bergen, Passaic, Morris, Essex, Hudson, Middlesex and Union. The lesser metropolitan area, that of Philadelphia, is much less definite in its direct boundaries. By implication it may be made to include all Southern and Central New Jersey, although the New York influence is strong in Atlantic City and along the 'shore' of Ocean County, and is felt in Vineland and Bridgeton. Trenton marks the point of separation between the influences of New York and Philadelphia, although the towns of the Delaware Valley between Trenton and Philadelphia are in closer touch with Philadelphia than with New York City. Warren and Sussex Counties are associated, however, with Philadelphia. Strictly speaking then the metropolitan area of Philadelphia embraces Burlington County, Camden, Gloucester, Cape May and Salem Counties, a large portion of Cumberland County, together with Atlantic City. In cities, towns and villages within these counties, there are those who daily transact business in Philadelphia, and are in fact of the well defined 'commuter' class."[13]

During the hearing in the New York Harbor Case, Professor Emory R. Johnson in explaining the factors which created the "Metropolitan District" said:

"There are three general factors that * * * account for the commercial growth of New York City, using city in the sense of port. Those three general factors are the size and location of the harbor at New York, New York's advantage as a railroad terminal and third, the terminal facilities at New York."[14] That "As regards size, no other harbor on either seaboard of the United States, can rival that of New York."[15] That in mileage alone, "there are at New York, 921 miles of waterfront [measured around piers and shore line], at Boston 141, at Baltimore 120, at Philadelphia 37, at Norfolk 26, at New Orleans 41½, San Francisco 8, Galveston 8, at Seattle 139.9 miles."[16] That "New York is especially favored as regards the areas available for anchorage, and for the maneuvering of vessels while at the port."[17] "Room is a great factor in a port, and of the great ports of the world, perhaps the most serious limitations is one of area, not of frontage."[18] "New York has not only the deep and wide Hudson River and the useful East River, but also the Bay of New York and eventually will have large harbor areas in Jamaica Bay and Newark Bay. * * * The port is well situated for engaging in the commerce of the United States with Europe. * * * New York is centrally located for carrying on the coasting trade of the United States. For more than a century, it has been the principal point from which the coastwise commerce of the United States has been conducted. This trade is of large volume and value, and has contributed materially to the progress of New York."[19]

He further says: "*I use 'port' in the commercial sense of the entire harbor facilities in New Jersey and New York.* The Port of New York is the seaboard portal of the best highway approach to the West. The Hudson and Mohawk Rivers and the Low Divide crossed in reaching Lake Erie, make the New York State route to the West the natural transportation route connecting the Atlantic seaboard with the great interior of the country."[20] "When trade depended upon the products of the nearby sections, Philadelphia was the leading port and the largest city of the United States, but when the West, beyond the Alleghanies, became the chief source of export, New York and New Orleans became the two main export gateways. The Great Lakes were the highways that connected New York State and the East with the West."[21]

"The natural highway between the West and the seaboard was the highway which the Erie Canal opened up in 1825, and which highway, of course, was taken about 20 years later by the New York Central Railroad. * * *

"Before the West was economically connected with the East, the Mississippi River carried the larger volume of exports to the Gulf. New Orleans, being the port of the Mississippi River, naturally had for a time—that is, from 1832 to 1854—export trade of greater value than that which passed through New York, but the Erie Canal saved New York's export trade and gave first place to New York, some years before the Civil War."[22]

"The Erie Canal was a great commercial highway to and from the West until about 1870. Up to that time the success of New York depended, I think one may say primarily, upon the Erie Canal."[23]

"The terminal facilities at New York are on a gigantic scale. They have been provided, in part, by large terminal companies; in part by numerous steamship lines that reach the port, and in large measure by the City of New York.

"At no other American port has there been a comparable threefold activity in the work of providing terminals for the exchange of traffic between rail and water carriers. At no other port are there such long piers and such spacious docks. Public and private interests have expended upon the development of the port's facilities many times the amount invested at other ports.

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[12] See Lincoln's Exhibit A, record, New York Harbor Case, p. 8586.
[13] Lee's "New Jersey as a Colony and as a State," Vol. IV, pp. 278–80.
[14] Record in New York Harbor Case, p. 2343.
[15] Idem, p. 2344.
[16] Idem, p. 2344.
[17] Idem, p. 2345.
[18] Idem, p. 2345.
[19] Idem, pp. 2345, 2346.
[20] Idem, p. 2347.
[21] Idem, p. 2348.
[22] Idem, p. 2349.
[23] Idem, p. 2358.

" What I have said thus far is really in answer to your question, the factors that have made New York an important trade center."[24]

When the Interstate Commerce Commission had before it the case involving the port differentials, it treated "New York" as one large and comprehensive center (Clark, Commissioner, writing the opinion, 24 I. C. C., 55) and gave the following as the long list of natural and acquired advantages existing at the Port of New York:

A natural port.
Unlimited capacity for future development.
The Erie Canal.
Fast and frequent steamship service.
Option market.
Guarantee of quality of export flour.
Banking facilities.
Credit market.
Ocean rates.
Numerous established commercial and trade connections with foreign countries.

" Not doubting that New York has all of these advantages we inquire," said Commissioner Clark, " Which of them has not come as a gift of Nature or as a result of judicious investment or commercial enterprise? And which if any of them may, as a matter of law, be taken from New York or nullified by arbitrary rail rate adjustments that are not founded in reasonableness measured by the recognized standards, and the absence of unjust discrimination?"[25]

A NATURAL PORT

The port of New York is obviously the foremost factor which led to the creation of " The Metropolitan District." It was its excellence as a " natural port " that induced the representatives of the West India Company of Holland, to found the settlement of New Amsterdam, soon after the discovery of the Hudson River in 1609.[26]

These early settlers were trading experts, however, and so they soon proceeded to use their " natural port " to the best advantage. Realizing how great a factor is a break in transportation to the growth and prosperity of a community, in that this transfer of freight attracts to that point merchants, brokers, bankers, etc., they passed a law during Van Twiller's administration requiring all vessels, touching at New Amsterdam, to unload or reload or transfer, or failing that, to pay a fine. They also were the first colonists to organize a systematic coastwise and foreign trading fleet, which was so enterprising that England was obliged, in order to protect its own colonial merchant fleet, to enact laws with a view of putting an end to this competition.[27] This despite the fact that there were then 80,000 English colonists and only 7,000 Dutch, in North America!

A like spirit of commercial enterprise characterized the economic development of New York, throughout the colonial period, and up to 1830, in which year it outranked all American seaport cities as a shipping center.

" The depression in New England was only slightly less acute than in Pennsylvania. New York alone of all the Atlantic States increased the annual shipments to foreign markets, chiefly because the port of New York had after 1825 a direct canal route to the interior. In contrast with the reaction in the East, the foreign trade dependent upon the Mississippi River and the Port of New Orleans slowly advanced. By 1830, New Orleans was second only to New York in the export trade; its exports were double those of Boston and more than treble those of Philadelphia." [28]

" The import trade of every large Atlantic port except New York was depressed. The quantity of goods received at New York increased after 1825, when the Erie Canal provided a direct connection between that port and the Central West; but the improvement at New York did not end the general stagnation of the import trade of the country as a whole." [29]

The Erie Canal

The Erie Canal is the second important factor which stimulated the growth of " The Metropolitan District " and is to be included under the heading of " acquired advantages."

As early as 1724, the citizens of New York began to visualize what subsequently became in fact " the *Erie Canal.*" Cadwallader Colden, for forty years Surveyor General of the province of New York, reported to Governor Burnet on the fur trade with the Indians and spoke of " the carrying place between the Mohawk River and the river that leads into the Oneida Lake, which carrying place is only 3 miles long, except in very dry weather; from thence they go with the current down the Onondaga River to the Cataracqui Lake (Ontario).[30] In 1776, General Philip Schuyler suggested a canal between Hudson River and Lake Champlain.[31] In 1777, Gouverneur Morris, in a conversation with Morgan Lewis and General Philip Schuyler at Fort Edward, said " That at no very distant day, the waters of the great western seas would, by the aid of man, break their barriers, and mingle with those of the Hudson. * * * That numerous streams passed these barriers through natural channels, and that artificial ones might be conducted by the same routes." [32]

In July, 1783, Washington toured the northern central part of the state, traveling in all about 750 miles, most of the way on horseback. In a letter to Chevalier de Chastellux, October 12, 1783, he said:

" Prompted by these actual observations, I could not help taking a more contemplative and extensive view of the vast inland navigation of these United States, and could not but be struck with the immense diffusion and importance of it; and with the goodness of that Providence which has dealt his favours to us with so profuse a hand. Would to God we may have wisdom enough to improve them! I shall not rest contented until I have explored the western country, and traversed these

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[24] Record in New York Harbor Case, pp. 2359-60.
[25] 24 I. C. C. 55, 63.
[26] Johnson's " History of Domestic and Foreign Commerce of the United States," Vol. I, pp. 28, 29-30.
[27] Idem, pp. 162, 39.
[28] Idem, Vol. II, p. 39.
[29] Idem, Vol. II, pp. 37-8.
[30] Lincoln's " Constitutional History of New York," Vol. I, p. 691.
[31] Idem, Vol. I, p. 692.
[32] Idem, Vol. I, p. 693.

Chelsea Piers, Hudson River, Manhattan — In Transatlantic Liner Service — These Are Comparatively Modern Two-Story Piers

Hudson River Waterfront Yard in New Jersey — One of Nine Yards all Devoted to Distribution of Passengers and Freight

A Phase of Freight Handling in Manhattan — Dray, Railroad Car and Storage Usage of Streets in Freight Distribution lines (or a great part of them) which have given bounds to a new empire."[33]

De Witt Clinton, in 1794, with prophetic insight wrote:

"Great improvements must also take place which far surpass the momentum of power that a single nation can produce, but will with facility proceed from their united strength. Mountains, deserts, and oceans will feel its mighty force. It will not then be debated whether hills shall be prostrated, but whether the Alps and the Andes shall be levelled; nor whether sterile fields shall be fertilized, but whether the deserts of Africa shall feel the power of cultivation; nor whether rivers shall be joined, but whether the Caspian shall see the Mediterranean and the waves of the Pacific lave the Atlantic."[34]

The first canal constructed for commercial use within the territory of the United States was a short waterway in Orange County, New York, built in 1750, for transporting stone, by Lieutenant-Governor Cadwallader Colden.[35]

The earliest state legislation for providing means of communication by water was in April, 1787, when the legislature imposed a tonnage tax on vessels of ten tons and upward passing through the Overslaugh. The receipts from this tax were intended to be expended in removing obstructions from the Hudson River. About five years later, in March, 1792, the Western and the Northern Inland Lock Navigation companies were incorporated; the former to connect the navigable portion of the Hudson River with Lake Ontario and Seneca Lake, and the latter to open lock navigation from the navigable portions of the Hudson to Lake Champlain.[36] George Washington was the first president of the former company. In 1797, the Western Inland Lock Navigation Company was given permission to raise the sum of two hundred and fifty thousand dollars and its charter was extended twenty years.[37] By 1796, the improvements permitted the introduction of boats carrying 15 tons on the route from Schenectady to the Seneca River.[38] In 1802, however, the company met with difficulties and in 1812, it offered to surrender all its rights and interests to the state.

In the House, Peter Buel Porter, a New Englander, representing western New York, presented an eloquent picture of what could be done for the country through great natural roads and canals. He secured the appointment of a committee, and from this committee, came a bill providing that the Federal Government should take one-half of the capital stock of any corporation that might be chartered to build any of the roads, or dig any of the canals, suggested by Senator Gallatin.[39] Encouraged by the prospect of Federal aid, New York state created a commission to explore a route for inland navigation from the Hudson to Lake Erie and Lake Ontario. Nine of New York's leading men were appointed commissioners.[40] Among other things, they were to apply to Congress and the legislatures of the neighboring states for aid and co-operation.[41] McMaster says: "The answers were not encouraging. Tennessee instructed her senators and requested her representatives to vote for congressional aid. New Jersey was deeply interested in the canal, but could not help it herself, and saw no reason for asking the Federal Government to do so. Connecticut thought it inexpedient to act on the request. Vermont put off consideration. Massachusetts and Ohio followed the example of Tennessee."[42] The commission, however, failed to get Federal support. "In the end New York received nothing."

The commissioners, nevertheless, strongly urged the immediate beginning of the work, pointing out that even an expenditure of six million dollars in ten years, by a population of one million people, would not impose a grievous burden on any, and declaring that the needs were such as to demand a canal, and that to delay would result in nothing but loss to the state. They said: "The maxims of policy * * * seem imperatively to demand that the canal be made by her [the State], and for her own account, as soon as circumstances will permit. * * * Whether this subject be considered with a view to commerce and finance, or on the more extensive scale of policy, there would be a want of wisdom, and almost of piety, not to employ for public advantage those means which Divine Providence has placed so completely within our power."[43]

Then came the war of 1812 between the United States and England, in consequence of which, all projects for internal development were put aside.

In November, 1816, the commissioners reported that they had developed prospects for a loan of five million dollars in Europe, upon the credit of the state of New York for a period of ten or fifteen years, at an annual interest charge of six per cent. They rejected as exorbitant the offer of the directors of the Western Inland Lock Navigation Company of $190,000, for the shares held by them, exclusive of the 350 shares held by the state.[45]

On April 5, 1817, the state of New York passed an act levying a tax of twelve and one-half cents per bushel on salt manufactured in the western district of the state, as well as a tax of one dollar on each steamboat passenger traveling over thirty miles,— to provide for the payment of interest on the sums which might be borrowed for the construction of the canal and for the final redemption of the principal.

The extent to which the state would ultimately go was hardly foreseen even by these exceptionally far-sighted men. Would they have suspected that by 1917, New York would have actually expended and obligated itself to pay for the construction and maintenance of this canal system the sum of $641,859,102?[46]

To realize what courage of conviction and resoluteness of purpose was required in this development of our country, we need only to recall that it was said derisively that in Clinton's "big ditch would be buried the treasure of the state, to be watered by the tears of posterity."[47] People denounced it as visionary. Jefferson declared it a hundred years ahead of its time, saying that to think, at that day, of making a canal of three hundred and fifty miles through a wilderness was little short of madness. Madison thought that its cost would exceed the resources of the whole country, and refused to grant any national aid.

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[33] Lincoln's "Constitutional History of New York," Vol. I, pp. 693–4.

[34] "Life and Writings of De Witt Clinton," by W. M. Campbell, p. 23.

[35] Whitford's "History of New York Canals," Vol. I, p. 7.

[36] Idem, pp. 33–34.

[37] Idem, p. 39.

[38] Idem, p. 41.

[39] McMaster's "History of the People of the United States," Vol. III, pp. 475-8.

[40] Idem, pp. 478–9. Gouverneur Morris, Stephen Van Rensselaer, De Witt Clinton, Simon De Witt, William North, Thomas Eddy, Peter B. Porter, Robert R. Livingston and Robert Fulton.

[41] Idem, Vol. III, p. 479.

[42] Idem, Vol. III, p. 479.

[43] Whitford's "History of New York Canals," Vol. I, p. 70, quoting from Senate Journal, 1812, pp. 112–113.

[45] Idem, pp. 68–9.

[46] Record in New York Harbor Case, pp. 1471, 1473.

[47] Whitford's "History of New York Canals," Vol. I, p. 9.

The canal was opened on the 26th of November, 1825. Early on the morning of the appointed day, we are told, the village of Buffalo was thronged with people gathered there to see the departure of the first boat.[48] Upon its approach at Rochester, the following dialogue ensued:

"Question.— Who comes there?

"Answer.— Your Brothers from the west on the waters of the Great Lakes.

"Question.— By what means have they been diverted so far from their natural course?

"Answer.— By the channel of the Grand Erie Canal.

"Question.— By whose authority, and by whom, was a work of such magnitude accomplished?

"Answer.— By the authority and by the enterprise of the patriotic People of the State of New York.'"[49]

Arriving off Sandy Hook, the fleet formed a circle and "His Excellency Governor Clinton then proceeded to perform the ceremony of commingling the waters of the Lakes with the Ocean, by pouring a keg of that of Lake Erie into the Atlantic; upon which he delivered the following address:

"'This solemnity, at this place, on the first arrival of vessels from Lake Erie, is intended to indicate and commemorate the navigable communication, which has been accomplished between our Mediterranean Seas and the Atlantic Ocean, in about eight years, to the extent of more than four hundred and twenty-five miles, by the wisdom, public spirit, and energy of the people of the state of New York; and may the God of the Heavens and of the Earth smile most propitiously on this work, and render it subservient to the best interests of the human race.'"[50]

To complete the ceremony and to typify the commerce of New York with all nations, Dr. Samuel L. Mitchell then poured into the ocean bottles of water from various rivers of the world.[51] John Quincy Adams said that it was "an Event among those most worthy of commemoration, in the progress of human Affairs — an Event equally creditable to the enterprize and Perseverance of the People of New York; and by the accomplishment of which, in honouring themselves they have reflected honour upon the age and country to which they belong."[51]

The Railroads

With the acquisition of the great waterway to the Middle West, the economic growth of the port of New York continued with increased intensity. While the foreign trade at other American seaports declined from 1819 to 1820, the imports and exports handled at New York increased in volume.[52] This expansion continued until in 1860, when the port of New York handled 70 per cent of the entire import trade of the country an aggregate of $248,000,000, and also became preeminent as an exporting center.[53]

The development of railroads in the United States began almost simultaneously with the vogue of canal building. However, it was not until 1870 that they proved themselves serious competitors of water transportation.

The pioneer American railroad built for general use was the Baltimore & Ohio. The company was chartered in 1827 and thirteen miles of trackage was opened in 1830. Railway operation in New York state was started in 1831, when the Mohawk and Hudson, the parent company of the New York Central system, finished the construction of seventeen miles of roadbed between Albany and Schenectady. In 1842, Buffalo was reached. Between 1830 and 1835, railroad construction was pushed more rapidly in Pennsylvania than in any other state — two hundred miles being opened. The first division of the present Pennsylvania Railroad system was the Columbia Railroad, by which Philadelphia was connected with Columbia on the Susquehanna River in 1834. This road, it will be recalled, was built by that state. The Camden and Amboy, which connected Philadelphia with New York, was completed in 1837. It was during the decade following 1850, that the task of connecting the Atlantic seaboard with the Middle West was completed. The first trunk line to join New York and the Great Lakes was the Erie in 1851. Its western terminus was Dunkirk on Lake Erie. The same year the New York Central connected New York with Buffalo by the completion of the last link of the chain of roads. The Baltimore & Ohio also reached the Ohio River in 1851, and the following year, a through rail route was completed between Philadelphia and Pittsburg.[54] The Baltimore & Ohio reached New York city in 1886 and the Pennsylvania reached there in the seventies.

By this time, New York had become the metropolis of the United States. In 1850, the population of the borough of Manhattan, i. e., "Lesser New York", was 515,547, or if the boroughs of Queens, Kings and Richmond are included, i. e., "Greater New York", it amounted to 696,115. The population of Philadelphia was then 340,045, and that of Baltimore 169,054. By 1860, however, the population of what is known as "Lesser New York City", had grown to 813,669, and what is now known as "Greater New York City", to 1,174,779.[55]

The arrivals of coasting vessels at New York in 1830 numbered over four thousand, as compared to fourteen hundred arrivals from foreign ports. In 1828, it was estimated that the clearances from this port to points on the Delaware bay alone amounted to sixteen thousand five hundred and eight tons and the clearances to points on the Chesapeake Bay to fifty-one thousand tons.[56]

New York had then become the collecting and distributing center of a large part of the surplus products of New England, the Middle Atlantic states and the lake district. During the decade of 1850–1860, there was a marked growth in the number of steamship lines engaged in the coastwise trade that reached New York. It had a regular semi-monthly communication with Charleston, Savannah and Florida. There was communication also with New Orleans, Mobile and Havana, by a regular steamer service, and a weekly service with Petersburg, Norfolk, Richmond and Jacksonville. Another line also furnished service between New York and California via Havana and New Orleans.[57]

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[48] Whitford's "History of New York Canals," Vol. I, p. 123.

[49] Idem, Vol. I, p. 125.

[50] Idem, Vol. I, p. 127.

[51] Idem, Vol. I, p. 130.

[52] Johnson's "History of Domestic and Foreign Commerce of the United States," Vol. II, p. 37.

[53] Idem, Vol. II, p. 57.

[54] Johnson and Van Metre, "Principles of Railroad Transportation," pp. 22–23, 28–29.

[55] Whitford & Hale, exhibit 14, record, New York Harbor Case, p. 3105.

[56] Johnson's "History of Domestic and Foreign Commerce of the United States," Vol. I, p. 339.

It was natural, therefore, that the railroads, sponsored by the citizens of Baltimore and Philadelphia, in order to compete with this water traffic and secure their share of the collecting there, should seek to locate their termini on New York harbor.

Other railroad companies followed suit, until there were thirteen of them, with a mileage of 39,708.37 miles, sharing in the handling of the freight of " The Metropolitan District." [58]

These three factors then — the harbor of New York, with its shipping service, the Erie Canal and the railroads, together with the commercial enterprise and the farsighted policy of the city and state of New York — constitute the basic factors in the evolution of " The Metropolitan District."

The Relationship of Northern New Jersey With New York

Professor Johnson in his " History of Domestic and Foreign Commerce of the United States " writes:

" In the seventeenth century, and for a longer period, East Jersey was, economically considered, a dependency of New York, and before the close of the century Philadelphia had become the principal entrepot for West Jersey." [59]

Further on he states:

" Practically all of the external trade of the New York colony was handled through New York City. East Jersey, likewise, while under the political dominance of New York, handled its commerce through the same port. Until 1680, East Jersey was not permitted any other port of entry, and not until 1700 was it given control over its own customs duties. * * * It is hardly probable, however, that East Jersey would in any case have developed much foreign trade independent of New York before 1700. Until that time she was little more than a supply territory tributary to New York. * * *

"West Jersey, Pennsylvania, and Delaware constituted an economic district whose commercial center was in the towns on the lower Delaware. By 1690, Philadelphia had secured the unquestioned leadership in the trade of the Delaware region. * * * What they [Burlington, Gloucester and Salem] shipped out of the colony consisted principally of farm products and was sent mainly to Philadelphia, to be used in that market or to be exported abroad."[60]

This course, however, has not been detrimental to New Jersey.

In referring to the era of the turnpike, Thomas F. Gordon in his " Gazetteer of New Jersey," published in 1834, says, that the objects of incorporating turnpike companies were threefold; that one of the principal objects was the desire of facilitating communication between Philadelphia and New York; the need of an outlet for the products of the fields and mines of the northern interior; and the creation of a market in New York City, to which end metropolitan capital was largely invested in New Jersey turnpike enterprises.[61]

Again it was Alexander Hamilton who founded the city of Paterson in 1791. Having conceived the idea of creating an association which would demonstrate practically that the American people need no longer depend upon foreign countries for the manufacture of products necessary for ordinary use, he formed a stock company, personally raising the required capital. A site for the factory was chosen at the " Great Falls ", on the Passaic River, and " six square miles " about the site were incorporated into a municipality and called " Paterson ", in honor of the then governor who signed the charter. At the time there were but a few scattered huts in the vicinity.[62]

What is now Jersey City, formed in 1630 part of the Dutch patroonship of Pavonia, which was granted to Michael Pauw, and consisted of a small sandy peninsula — an island at high tide — called Powles-Hook. In 1764, it formed the eastern terminus of a postroad connecting New York City and Philadelphia, from which a ferry ran across the Hudson. In 1804, this strip of 117 acres of land, on which was a settlement of but 15 inhabitants, passed into the possession of three New York lawyers, who laid it out as a town, and formed an association for its government, which was incorporated as the "Association of the Jersey Company ". In 1820, the town was incorporated as the City of Jersey.[63]

Hoboken, or as it was then called Hobocanhacknigh, i. e., the place of the tobacco pipe, remained a Dutch farm until 1711, when its title was acquired by Samuel Bayard. The latter improved the grounds and erected on them his summer residence. Later in 1804, and for thirty-five years thereafter, the Hoboken " Elysian Fields " enjoyed fame as the favorite pleasure resort of New York City. However, it was not incorporated as a city until 1855.[64]

The first use of Weehawken was as a duelling ground for residents of New York city.[65]

" In 1730, some Dutch families immigrated from Albany, N. Y., and located along the line of the public road [in what is now New Brunswick], which they called 'Albany Street.' Among these settlers were Dirck Schuyler, Hendrick Van Dursen, Dirck Van Veghten, Abraham Schuyler, John Tenbroack, Nicholas Van Dyke and Dirck Van Alan, who were men of considerable property and enterprise. The city became a growing town."[66] Prior to this settlement of New York immigrants, New Brunswick consisted of a ferry landing place as its early name " Indian's Ferry " suggests.

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[57] Johnson's " History of Domestic and Foreign Commerce of the United States," Vol. I, pp. 346–7.

[58] Lincoln's exhibit 2, record, New York Harbor Case, p. 2629.

[59] Vol. I, p. 68.

[60] Vol. I, p. 78.

[61] " Turnpikes. Since March, 1801, authority has been given for making 54 turnpike roads." The object of these improvements seems threefold. 1. The facilitating the communication between the great cities of New York and Philadelphia. 2. The more ready approach from the interior to the markets of New York and Easton, for the products of agriculture and the mines; and 3. The drawing the produce of the Delaware river, to the waters of East Jersey and New York, all which has been much aided by the capital of that great city." (Gordon's " A Gazetteer of the State of New Jersey," p. 17.)

[62] " The Passaic Valley," by John Whitehead (1901), Vol. I, pp. 15–24.

[63] Encyclopedia Britannica, Vol. XV, p. 331 (11th ed.).

[64] Idem, Vol. XIII, p. 553.

[65] Idem, Vol. XXVIII, p. 466.

The Passaic Valley Sewerage Case

By Chapter 539 of the laws of 1903, the New York Legislature appointed a commission to investigate certain threatened pollution of waters in New York Bay, the commission consisting of Daniel Lewis, Chairman, Olin H. Landreth, George A. Soper, Myron S. Falk and Louis L. Tribus.

This Commission made its first report on March 31, 1905, and its second report April 30, 1906. In its report of March 31, 1905, it emphasized in the following language the needs of the metropolitan district as a whole and the desirability of joint State action: " It has been suggested, therefore, that a metropolitan sewerage district should be established, to include all sections in both New York State and New Jersey which now or in future may sewer into the bay and its tributaries. This district, when authorized by joint State and Federal legislation, should be under the direction and control of a permanent interstate commission, with plenary power to control the discharge of all sewers hereafter constructed, as well as the task of evolving a comprehensive plan for ultimately rendering the present chaotic and systemless method of sewage disposal sanitary and suitable for all future requirements.

" There seems to be no possibility of a comprehensive treatment of this great question through the action of various and constantly changing local authorities, acting independently. Manhattan may continue, as at present, to follow no system whatever, simply emptying a new sewer into North or East River at any place where grades permit, even though a recreation pier or public bath may be already established at the same point. Brooklyn may, and probably will, carry its sewage into the sea, and thus ruin the bathing beaches within its limits, and pollute the great oyster beds therein, and Westchester county for forty miles from the city may contribute a large amount of sewage, while the State of New Jersey, with its constantly increasing population, will add to its present outflow from year to year.

" The necessity already exists for a central authority to not only direct, but also initiate, these great public works, upon which depend the beauty and healthfulness of the approximately 450 miles of shore within the metropolitan district.

" Immediate action should be commenced to secure such an interstate commission, for the existing conditions must steadily approach the point where the public will demand relief.

" In this country there is at present but one locality at all analogous to New York in this respect, viz., Boston, where a great metropolitan district empties its sewage into the harbor, but the difference in governing conditions is radical, as but one State is in control, while for New York harbor two great commonwealths would have to join forces.

" England permitted the pollution of the Thames for centuries, but at last was compelled to purify its waters at a cost far exceeding the expense of *preventing* such contamination had the demands of competent judges been complied with a hundred years ago.

" If New York and New Jersey should now initiate the plan above outlined the mistakes of other great municipalities could be happily avoided."

In support of the policy urged by the commission it obtained from Attorney-General John Cunneen an opinion upon the question " Whether in the event this commission finds it desirable to recommend for future consideration the establishment of a metropolitan sewerage district, covering parts of the two States of New York and New Jersey, the Legislatures of the two States have authority to establish such a district and appoint a commission having adequate powers of administration," the Attorney-General answering the question as follows: " I am of the opinion that the States of New York and New Jersey may, if they see fit, construct a metropolitan sewerage district, covering parts of the territory of the two States, and giving jurisdiction thereover to the courts of one or the other of said two States, as to all matters pertaining to the proper sewerage of said district. Such concurrent acts of the States of New York and New Jersey should, however, in my judgment, be approved and ratified by an act of Congress, for the reasons hereinbefore set forth, namely, that the Federal Government has supreme control over the navigable waters of the Hudson River and New York Bay, and its approval should, therefore, be had to the joint action of the contiguous States."

Notwithstanding the very wise suggestion on the part of the New York Bay Pollution Commission, no attempt was made since 1906 to bring the States together upon a compact which would cover this important matter and create the central authority recommended by the commission of 1903.

On the seventeenth day of October, 1908, suit was brought in the United States Supreme Court by the State of New York against the State of New Jersey and the Passaic Valley Sewerage Commission to restrain the construction and operation of the trunk-line sewer authorized by the State of New Jersey; the contention of the State of New York being that New Jersey was discharging sewage in New York Bay to the injury of New York. Among the defences to this suit is the charge that New York State has no standing in the Court of Equity because of its failure to come into court with " clean hands," it being charged that New York is emptying its sewage into New York Bay. This suit was brought by a bill in Equity filed October 17, 1908. The answer was filed January 24, 1909. Taking of testimony was begun June 26, 1911, and closed on June 27, 1913. On November 11, 1918, the case was brought on for argument and the United States Supreme Court directed that case be restored to the docket in order that further testimony should be taken " as to the present degree of pollution of the waters of New York harbor including those parts affected or to be affected by the proposed Passaic Valley Sewerage System and by the sewage of the City of New York;

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[66] " The City of New Brunswick," issued by the New Brunswick Times (1909), pp. 6–7.

and the change, if any, in the degree of such pollution since the time to which the testimony heretofore taken relates." See 249 U. S., p. 202.

Obviously if the recommendations of the New York Bay Pollution Commission had been accepted and a Metropolitan District had been created with a single sanitary commission controlling the Port of New York, the litigation would have been wholly unnecessary. This litigation has created a great deal of feeling both in New York and New Jersey and has not been conducive to the bringing about of cordial relations between the states. The resolutions adopted by the Board of Estimate and Apportionment of the City of New York (see Appendix D, Part III, relating to Treaty). The Board said:

"This Board invites and will welcome the active and earnest co-operation of New Jersey in any movement tending to improve and develop the Port of New York in all its parts and to the fullest extent, including matters relating to river and harbor pollution, which now constitutes a grave menace to the harbor of New York * * * "

Our Commission has not found it practicable to include at the present time the power to regulate the matter of harbor pollution in the Proposed Compact though it has preserved the opportunity for vesting such power ultimately in the Port Authority. Public opinion in New Jersey will not support an agreement at this time until there is a disposition of the litigation in the United States Supreme Court either by judgment of that Court or by withdrawal of the suit by New York.

New York Harbor Case

In 1911 Governor Wilson of New Jersey appointed a commission of three members to study the problem of port development in co-operation with a similar body representing the State of New York. Following the report of the New Jersey Commission to the Legislature of that State in 1914, the New Jersey Harbor Commission was created, consisting of five members.

In 1915 the Commission was merged together with several others into the New Jersey Board of Commerce and Navigation. As the result of reports, made by that Commission to the then Governor of New Jersey, Hon. James F. Fielder, he appointed a special committee to discover ways and means of securing a readjustment of freight rates. That committee which was known as the "Committee on Ways and Means to Prosecute the Case of Alleged Railroad Rate and Service Discrimination at the Port of New York" joined with the New Jersey Board of Commerce and Navigation and with the cities of Newark, Hoboken, Jersey City and Elizabeth, instituted a proceeding before the Interstate Commerce Commission entitled "Committee on Ways and Means to prosecute the case of alleged Railroad rate and service discrimination at the port of New York, Board of Commerce and Navigation of the State of New Jersey, the City of Newark, City of Jersey City, the City of Hoboken, and the City of Elizabeth, all in the State of New Jersey, v. the Baltimore & Ohio Railroad Company, et al.", and which is officially known as *the New York Harbor Case,* No. 8994. This case aroused very considerable opposition on the part of the State of New York, the City of New York and various civic and commercial bodies. The Chamber of Commerce of the State of New York in an intervening petition filed on the 19th day of October, 1916, alleged that the proceeding was "instituted for the purpose of shifting the basic center of the commerce of the Port of New York and thus artificially to stimulate the transfer of commercial and industrial advantages to the State of New Jersey, but to the great disadvantage of the city and state of New York."

The State of New York intervening in the proceedings by the Attorney-General alleged that[67] "To break up the present Port of New York into two ports — one a Jersey and one a New York port — is to abandon the policy of co-operation and of friendliness that for over a century has existed between the two States, and to develop a rivalry disadvantageous to both."

The City of New York[68] intervening in the litigation charged "That the complaint * * * in this proceeding proposes a reorganization of the Port of New York as a whole in favor of the complainants, and to the damage of your petitioner, and which would give to the complainants certain advantages."

In the proceeding before the Interstate Commerce Commission much testimony was taken, many exhibits filed and the history of the relationship of the states of New York and New Jersey gone into with considerable detail. The complainants contended that the whole organization of the port was fundamentally wrong. In their complaint they alleged "Under the unscientific and uneconomic methods practiced by the carriers, and before referred to, the business of the Port of New York has been developed along wholly artificial in lieu of natural lines. The result is that the City of New York has become so congested with traffic, and the price of land, owing to this artificially created demand, has risen so high, that the expense of conducting business on Manhattan Island has become excessive. High rents, high taxes, high insurance rates, congestion of the streets, congestion at the pier stations and shipping yards of the railroads, the wasteful methods in handling and rehandling all foodstuffs consumed, the value of which is estimated at more than $700,000,000 per annum, with the consequent heavy cost of drayage, estimated at $50,000,000 per annum, the loss to the railroads themselves in carrying goods across the Bay and back again, in some cases only for storage, are all a burdensome tax upon business conducted at this port, which can only be completely removed by the reorganization of the Port as a whole, and utilizing the advantages of the New Jersey shore and navigable waterways near its great Port.

"While the difficulties growing out of the European war have materially increased the congestion at the Port, nevertheless the congestion and expense arising out of the conditions herein described have become a normal condition, and some remedy must soon be found if the natural advantages of the Port are to be fully availed of.

"This condition also affects not only the Port of New York, but practically the entire industrial situation in

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[67] Julius Henry Cohen, Special Deputy Attorney-General.

[68] Former Attorney-General George W. Wickersham, Special Counsel.

Outshore End of Navy Base Pier in Brooklyn — Railroad Tracks Along Each Side of Pier Shed

Interior of Navy Base Pier in Brooklyn

Piers at a Brooklyn Terminal — Various Types of Lighters Necessary to the Steamship Service of the Port the United States, as the excessive cost of doing business at the Port of New York under existing conditions, affects all of the industries of America whose products pass through or come to the Port for distribution. The problem therefore is really a national one, and is not confined solely to a local situation. It involves the handling of many times the maximum amount of tonnage that is estimated will go through the Panama Canal.

"The importance of adequate facilities for transportation of troops and freight from the West or South to the East by means of intercommunication, which may be quickly and readily availed of, if necessary, without passing through the Port, in the event of war, likewise mark the existing condition of congestion as a national rather than a local problem.

"This difficulty cannot be cured by temporary arrangements or any expedients, such as temporarily shortening the time to shippers on the New York side in which to remove their goods. The only way that this difficulty can be solved permanently and in the interest of the whole country, is to so readjust and reorganize the port as between New York and New Jersey territory, as to put into intensive use all the natural conditions, and give to the New Jersey side advantages which nature has provided. Such a reorganization, on scientific lines, will remove the unjust burden now imposed upon New Jersey, will relieve very greatly the port congestion, and enable all business at this port to be conducted on the basis of the greatest possible economy, thereby saving to the carriers millions that are now being lost each year by reason of unscientific methods and the failure to provide adequate facilities."

To accomplish this result they urged upon the final argument "that if New Jersey is put substantially upon the Philadelphia basis in the matter of rates it will result in a development of the New Jersey territory in a way that will be of great advantage to the port of New York as a whole," and their position was defined in the brief filed on their behalf as follows:

"The specific relief sought by the complainants is the creation of a New Jersey rate zone, which, starting with the termini of the trunk line carriers along the Jersey shore of the Hudson River, will embrace all intermediate main-line points now located within that portion of New Jersey included within the New York rate zone, and the establishment of a spread of at least 2 cents per hundred pounds in the rates to and from this New Jersey zone, from and to points west thereof, as compared with the rates to and from New York, to and from the same points."

In the opinion of the Interstate Commerce Commission rendered upon the whole case, Commissioner Harlan said:

"The complainants take the position that the inadequacy of the present facilities at the port of New York and the consequent congestion of freight there are attributable at least in part to the application of a common rate of freight to and from points bordering on the harbor. As long as the railroads perform the expensive lighterage and floatage service without imposing an additional charge therefor, the freight rates offer no inducement to the steamship companies to seek pier space on the New Jersey shore rather than in Manhattan or Brooklyn; and the maintenance of a common rate to and from both sides of the port tends to increase rather than to diminish the congestion of freight on the shores of Manhattan and Brooklyn. If the freight rates to and from the New Jersey shore were lower, ocean shipping would be attracted to the New Jersey side of the harbor and more industries would be induced to locate there. The complainants contend that this result would be desirable, not only because it would relieve the congestion at the port, an ever-present problem, but because it would enable the defendants to avoid the great expense they now incur in performing a transfer service which the complainants deem unnecessary. There is some disagreement among the witnesses as to whether or not the present practice of handling freight in lighters is wasteful, nor are they in accord as to the relative advantages and disadvantages of loading and unloading freight directly between piers and vessels on the one hand and lightering it on the other. It seems to be agreed that solid trainloads of some commodities may be loaded and unloaded most economically and expeditiously if facilities are provided for the direct interchange of freight between car and vessel, and that lighters may be employed to better advantage when the cargo is of a miscellaneous character. The vessels entering and leaving New York harbor usually carry miscellaneous freight. In loading a miscellaneous cargo directly from cars to vessel it is important to have the cars shunted onto the pier in the exact order required for the proper loading of the vessel, and if they do not arrive in the proper order confusion and delay result. Lighters, on the other hand, may arrive in any order, and those not needed immediately can be conveniently placed to one side while others are unloading. Moreover, a lighter may contain from 600 to 1,000 tons of freight, from 20 to 30 times as much as the average car. Perhaps the most efficient method is the one employed at the piers of some of the private terminal companies, where a vessel can take its cargo from cars and lighters at the same time; and if the necessary accommodations for ocean-going vessels were provided on the New Jersey shore near the railroad terminals, this method of interchange could be employed to better advantage there than in any other part of the harbor.

"The complainants call attention to the fact that approximately 50 per cent of the country's total export and import traffic passes through the port of New York. It is estimated that 10,000,000 tons of freight annually would be affected by a change in the rates here in issue, and that of the total tonnage coming to the New Jersey shore from the west, from 85 to 90 per cent is carried in lighters or on car floats to the east side of the harbor. If it be true that an expensive and unnecessary lighterage service is performed on such an enormous tonnage, it is obvious that the present method of handling freight at the port involves a huge economic loss which is in a sense an unjustifiable burden upon the people of the whole country. The complainants also insist that the defendants' policy of transferring freight across the harbor without imposing a higher rate for that service encourages the continuation of the wasteful practices which have long prevailed, and they contend that the establishment of lower rates to and from the New Jersey side of the port would not only accord to the people of New Jersey an advantage to which their favorable location entitles them but would relieve the people of the whole country of an unnecessary burden which is directly attributable to the present rate adjustment. The various benefits which would accrue to practically all parties in interest if lower freight rates were published to and from the New Jersey shore are enumerated as follows by the complainants:

> "New York will gain from the relieving of the existing congestion which will be made possible by the transfer of steamers to the New Jersey shore, leaving room for the expansion of the railroad facilities for lighterage service. It will gain from its share of the increased export and import business which will come to the port. It will gain in the collateral advantages that come to New York from the growth of the New Jersey suburban section.
>
> "The railroads will gain in the saving of the excess cost over the revenue which they lose in lightering goods to New York and back again to the extent that this business would be done on the New Jersey side. They would gain in the increased export and import business that would come to the port.
>
> "The main trunk lines would gain by obtaining business which now goes to the west by our coastwise steamers.
>
> "New Jersey would gain from the increased business that would come to New Jersey from New York, and in the increased business that would be attracted to this port.
>
> "The whole country would gain in being saved the needless tax upon commerce which is involved in the existence of the present free lighterage practice."

In opposition to the position of New Jersey, New York State and New York City took the position that the Metropolitan District was a natural rate zone; that historically, geographically and commercially it was one district and that the port "should not be split."

In the case, New York further took the position that New Jersey had not been injured by any discrimination and for that purpose submitted evidence showing the great progress of Northern New Jersey. Tables based upon study of the statistics of the growth of New Jersey's population showed that from 1790 to 1900 there was a percentage increase of 966.35, and throughout that period it has been those counties nearest New York that have grown the more rapidly. For Bergen, for instance, the percentage of increase was 4822.54; for Essex 3267.61; for Middlesex 507.32; for Morris 308.85 and for Monmouth 472.09.[69]

Table IX showed that the center of population of New Jersey had remained constantly within the northern counties of New Jersey.

Other tables submitted by New York indicated a significant parallelism in the growth of the northern counties of New Jersey with that of New York, thus showing the economic unity of the whole territory: "the Metropolitan District."

The percentage increases by five and ten year periods of population in states, county groups and nation, beginning with 1790, showed that the percentage increase of the Northern New Jersey County Group[70] was the same as that of New York State and the State of New Jersey until 1820. By 1830, the margin between the line of the "New Jersey Counties Group" and that of the "State of New Jersey" begins to widen. Between 1840 and 1860, it widens further so that there is a difference of nearly two hundred per cent. By 1860, the "New Jersey Counties Group" line crosses that of the "United States," while the line of "State of New Jersey" continues in parallel growth with that of the "United States." By 1875, the "New Jersey Counties Group" line, rapidly advancing, crosses the line of "New York State." From 1880 until the present time, the line of percentage increase of the "New Jersey Counties Group" parallels almost identically the line of "Greater New York." (These same lines of development were proved in many other ways by the charts.)[71]

In this case Mr. James M. Reilly, Secretary of the Newark Board of Trade, said: "The Port of New York comprehends the Jersey shore just as much as any other part of the port * * * and if it had been a part of the greater city, every advantage, every foot of its water frontage would have been availed of and have been developed."[72] "It would be a wonderful result if all of the interests concerned in this question, could realize the great advantages which would accrue to Greater New York and to all this northern section of New Jersey, if it could be incorporated into one great commercial and industrial center, through a change in the present boundary lines; or, in other words, if it were possible to have Congress create a new state, comprehending such contiguous territory, whose interests are inter-related, and within which the problem of transportation facilities must be worked out for the benefit of the entire nation."[72a]

The decision of the Interstate Commerce Commission declining to disturb the existing rate situation said among other things:

"The complainants' contention that the methods of handling both domestic and export traffic at the Port of New York *must be thoroughly revised if the maximum of efficiency is to be attained is abundantly established by the evidence of record.* Adequate freight tunnels under the North River, which apparently could be constructed at a cost small in comparison with the resulting benefits, would make it possible to handle a large portion of Manhattan's freight traffic without the use of lighters or car floats. *A large part of the valuable water front on the New Jersey shore, now used almost wholly for the transfer of freight between the rails and the floating equipment could be released for other and more suitable purposes; the congestion on the west side of Manhattan Island caused by the assembling of countless vehicles at the crowded piers to receive and discharge freight would be considerably relieved; and the pier stations on the Manhattan shore, now taxed to capacity, could be devoted in part to other uses.*

"We can not with propriety overlook the fact that the terminal problem at the port of New York is due in no small measure to the competition between the railroads. With convenient through routes available to the shipping public over the lines of all the carriers, and with the same rates of freight applying over all the routes, practically the only field of competition left to the railroads is that provided by their separate terminal operations. A shipper will employ the services of the carrier which offers him the most convenient facilities for the receipt and delivery of his shipments. It is this rivalry between the railroads in the matter of terminal service that has induced them to lay hold of almost every available foot of land on the New Jersey side of the harbor. It is this rivalry that prevents the establishment of reciprocal switching arrangements and joint terminal operation on the New Jersey shore, and for the difficulties encountered in endeavoring to persuade the railroads to construct freight tunnels under the river between New Jersey and Manhattan. And it is this rivalry that tempts the carriers to invest large sums in new terminals for their individual use instead of uniting in a common effort to solve in a larger way a problem whose solution can never be attained as long as the present policy of unrestrained competition is continued. It is not too much to expect that the defendants will take immediate steps to reorganize and coordinate their terminal facilities at the port. There can be no justification, especially in a time of national emergency, for a policy that permits certain terminals to be congested with a surplus of freight while at the same time a near-by terminal has not enough traffic to keep it busy. *It is necessary that the great terminals at the port of New York be made practically one, and that the separate interests of the individual carriers, so long an insuperable obstacle to any constructive plan of terminal development, be subordinated to the public interest.*"

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[69] "A Century of Population Growth," Dept. of Commerce, p. 60 (1909).

[70] The term "New Jersey Counties Group" means the counties of Union, Essex, Passaic, Bergen and Hudson taken together. Record in New York Harbor Case, p. 3104.

[71] The method of comparison by means of percentage-increases is that used in the Federal census and is the method generally in use in most comparisons that involve records for successive periods of time. It is also the method most easily understood by the public at large.

[72] Record in New York Harbor Case, p. 1081.

[72a] Record in New York Harbor Case, p. 1080.

"The ever-increasing cost of terminals and of terminal services presents a problem which the carriers must sooner or later face and solve. In the early days, when terminals were small and inexpensive, the cost of the line haul was the most conspicuous item of expense in the transportation service performed by the railroad. The New York Central, for example, employed ordinary team tracks in making its deliveries on Manhattan Island. Its present terminal facilities in Manhattan, including its expensive warehouses and lighterage and floatage equipment, are worth many millions of dollars, and an additional expenditure of more than $50,000,000 in the near future is planned. The plans of the Lehigh Valley and the Lackawanna for new terminals on the Jersey shore have already been mentioned.

"*The unusual cost of the terminal service at the port of New York* and the plans of the carriers serving the port to invest many millions of dollars in new terminals adds peculiar interest to the question whether the railroads can continue indefinitely their policy of rendering valuable terminal services without imposing specific terminal charges therefor. In that connection the comments of one of the witnesses in this case are worthy of careful consideration.

"'The essential defect of the country's railroad system is the great cost of terminal handling as compared with the economy of hauling the trains, and nowhere is this defect more in evidence than at New York. Defective city terminals throughout the land must be enlarged, modernized, and integrated. At each city, as in the cities of Europe, the terminals will come to be conducted as administrative units. These changes of policy involve vast expenditures which can only be recouped by terminal service charges, and consequently there must be substituted for the old-fashioned practice of individualistic competing terminals a modern policy of terminal integration and a segregation of terminal charges from hauling charges.'

"It is maintained by some experts on harbor development that no port is to be regarded as ideal unless its facilities are so arranged as to provide for the direct and economical interchange of freight between the rail carriers and the boat lines serving it. There should be spacious piers on the water front adjacent to the terminals of the rail lines; the railroad tracks should extend onto the piers; and freight should be transferred directly between the cars and the vessels.

"If this principle is sound, the very statement of it constitutes a serious indictment of the prevailing conditions at the port of New York, since the terminals of nearly all the trunk lines at that port are on the New Jersey shore, while most of the ocean lines have their piers either on Manhattan Island or at South Brooklyn, distant from 1 mile to 4 miles from the rail terminals. To a specialist in port development it is 'a surprising fact that not a single steamship pier on Manhattan Island has a railroad track on it connected to a trunk line railroad, or even to a switching railroad by which the trunk lines might be reached.'

"*The difficulty of attaining a physical co-ordination of facilities at the port, and administering them as an organic whole, is attributable in part to the nature of the harbor and to the fact that the opposite sides of the port lie in different states.* One of the peculiar features of the port is its division into separate units. Manhattan, as previously explained, is separated from other parts of the port by the Hudson River, the East River, and New York Bay. Staten Island, separated from Manhattan by the waters of the upper bay, presents peculiarly difficult problems to those who believe that the port can best be developed by coordinating its various parts and bringing them under a single administrative authority. Brooklyn located on Long Island, is separated from New Jersey by the broad waters of the upper bay, and from Manhattan by the East River. *That part of the port lying west of the Hudson River is in the state of New Jersey, and the fact that the port is thus divided into two parts by a state line can not be overlooked by those who would understand its history and the problem confronting those who are interested in its development.*"

The Port of New York a Commercial and Industrial Unit

"In that part of the state of New Jersey lying within a radius of 30 miles of Manhattan Island there are several cities engaged in manufacturing, including Newark, Jersey City, Paterson, Perth Amboy, Hoboken, Elizabeth, New Brunswick and Passaic. * * *

"The industrial district of northern New Jersey is so near the city of New York, and so densely populated that the whole region, both in New York and in New

Jersey, is commonly referred to as 'the metropolitan district.' Many thousands of people who are employed in New York have their homes in New Jersey, and every morning and evening the ferries, subway 'tubes,' and suburban trains are crowded with commuters traveling between their homes and their places of business. *In this respect northern New Jersey is quite as much a part of New York as is Brooklyn or Staten Island.* Moreover, eight counties of northern New Jersey, including those in the metropolitan district, are embraced in the New York customs district as defined by the Federal government; and throughout the metropolitan district there are industries engaged in the manufacture of the same articles, drawing their raw materials from the same source, and disposing of their products in common markets. The evidence shows that their proximity to New York has not been unfortunate for the cities of northern New Jersey. In the 1902 'Year Book' of the Board of Trade of Newark, N. J., we read:

"'The richest city in the world keeps an open door for the products of our mills, workshops, and factories. The millions of capital employed in promoting the distribution of the world's products from the warerooms of New York are at the command of our business men and the fleets of all nations riding on the waters of the Hudson and East rivers stand ready to distribute these products in all parts of the world at the lowest possible cost to the producer.'[73]

"The defendants raise the point that both sides of the port have for years been accorded the same rates by the boat lines serving it. Since the very earliest days of transportation through the Erie Canal it has been customary to apply the same rates by boat from Manhattan and Brooklyn as from Jersey City and Hoboken, and the same policy will be followed when the new barge canal is completed. The advantages which New Jersey may derive from the opportunities afforded by the new canal have already been mentioned. Moreover, the rates published by the carriers operating over the ocean-and-rail routes, which carry a large tonnage between New York harbor and points in the west, are the same from Jersey City and Hoboken as from New York, although all of the vessels engaged in this traffic sail from the Manhattan side, and an additional lighterage service must therefore be performed on traffic moving to or from points in New Jersey. All parts of the port are regarded as a rate group in the construction of export rates, the defendants' export rates applying to ship side, and, as we shall see later, the complainants concede that that adjustment should be continued. The fact that the boat lines have so long accorded the same rates to both sides of the port is thought by the defendants and the interveners to suggest the undesirability of requiring the trunk lines to construct their domestic rates in such a way as to 'split the port.'

"The report of the interurban committee of the Newark Board of Trade for December, 1906, refers to the fact that a large part of the port of New York lies in New Jersey, and as if for the purpose of emphasizing this thought a map of the whole port is printed on the first page of the report, over which are prominently displayed the words: 'Northern New Jersey Considered as Part of the Port of New York.' The map, which is reproduced in Appendix E, seems to show beyond question that even from the New Jersey viewpoint the port is properly to be considered as an organic whole. At any rate it is obviously necessary, in determining the propriety of requiring a departure from the long established practice of according the same rates of freight to all parts of the metropolitan district, to give due consideration to the fact that the whole district is an industrial and commercial unit."

The Interstate Commerce Commission found "that there is merit in the contention of the New York interveners that the *metropolitan* district should be regarded as a unit, and that lower rates to and from northern New Jersey would subject New York to undue prejudice," and finally the Commission said that it could not

"overlook the fact that *historically, geographically, and commercially New York and the industrial district in the northern part of the state of New Jersey constitute a single community;*" nevertheless, it said that the position taken by the complainants, (New Jersey), "*is in a measure justified from an economic viewpoint, and that while at the present time all parts of the metropolitan district may with propriety be grouped for ratemaking purposes, there may come a time when the burden of handling the enormous tonnage in and out of the port will be so onerous that Manhattan itself may need such relief as lower rates to and from the New Jersey shore would in part afford.*"

While the New York Harbor Case was pending it resulted in great discussion of the problem of port organization. Every trade and civic body within the Metropolitan District became vitally interested. The cities and commercial organizations along the Hudson intervened in the proceeding. The daily press was sharp and critical in its comments. In the New York press New Jersey was attacked for "the split of the Port of New York." In the New Jersey press New York was attacked for "its selfishness and narrow-mindedness." Fortunately, the case had an educational influence upon all of the participants as well as upon those concerned with the future development of the Metropolitan District, and even while the case was pending, there gradually emerged the conception that whatever New Jersey might gain through success in the litigation, it could gain more through co-operation with New York, and that, on the other hand, New York could not afford to ignore the fact that it had heretofore regarded that portion of the port within state lines as being the entire port.

Thus it came about that upon the invitation of the New York State Chamber of Commerce, Governor Edge of New Jersey and Governor Whitman of New York were brought into conference.

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[73] The president of the Public Service Corporation of New Jersey said in a recent address: "It is undoubtedly true, as all these authorities show, that the drift is away from Manhattan as a place of residence and as a place of industrial manufacture, out to the immediate suburbs; and those suburbs are, as I said a moment ago, Westchester County, the borough of Bronx, Long Island, and New Jersey * * *. In 1890 the population of New Jersey was in round figures, 1,450,000; in 1900 it was 1,500,000; in 1910 2,500,000; and in 1915, 2,850,000 * * *; for while it is true that we prosper largely because of our proximity to New York as a suburban place of residence, the commercial aspect of the growth is even of more importance, and for that same reason * * * *. It may interest you to know that this line from Newark to New York (referring to the Hudson 'tubes') is every day of the year carrying to and fro thirty-odd thousand people — over a million a month."

In an address made by Honorable Walter E. Edge, Governor of the State of New Jersey, to the New York State Chamber of Commerce on March 1, 1917, Governor Edge said:

" I want to see industrial New York and industrial New Jersey cooperating, especially located as they are, with this wonderful harbor between — and the harbor, my friends, is not alone New York's; the harbor is a national institution — and I feel very strongly on the subject of helping in its development, helping to relieve its congestion, helping to connect its business interests on either side of the harbor. In that way it will make for a greater development."

In the brief filed on behalf of the State of New York referring to the Port of New York " as a trust for the nation at large " counsel for New York said:

" That this service can be improved, that its present cost can be lessened, that more thoughtful, constructive and comprehensive use can be made of it, no one questions. But how is it to come about? By destroying the switchboard? By terminating the service? Of course, not. Governors Whitman and Edge have given the answer.[74] Let all hands turn to and co-operate in the solution of this great problem. Its final engineering solution will require the constructive mind of a great engineer (such as that of the man who planned the Panama Canal) and hundreds of millions of dollars (such as was required for the Erie Canal and for the great subway facilities of New York). But, if it is to be finally brought about, there must be provided better political organization of the municipalities of New Jersey and legal power on all sides of the harbor to deal collectively with the constructive program that will be evolved. Obviously, this could not come about before. It required an aroused and awakened New Jersey and New York City whose transit problem was past the state of initiation and development, and a New York State whose canal problem was well under way of solution. But over and above all other things, it required a liberal spirit on all sides which would break down political barriers, put aside petty rivalries or jealousies, and free itself from the short-sightedness that handicapped De Witt Clinton in the nineteenth and Irving Bush in the twentieth centuries. Not the spirit of profit 'without a penny of expense,' as Mr. Meigs advised Jersey City, but a willingness to make common sacrifice for a common future. The hearings upon this application have already developed healthy elements of co-operation and thus may make of these proceedings a blessing in disguise; but the *grant* of the application — the creation of this 'New Jersey' zone — would destroy the new-born spirit, would paralyze the initiative and palsy the hands of those who would put endeavor into this great work. As Mr. Sheridan of Baltimore said:[75] 'It may be that had this case been considered in all of the aspects that have been brought to light at this hearing, the complaint would not have been brought as it is presented, but having been presented, I see possibilities for great benefits to follow, in this — if I would not be considered presumptuous in going to this length — a recognition of latent possibilities on the Jersey shore, which are inherent and capable of very great expansion. Recognition on the part of Manhattan of those, together with deserved claim for recognition of what Manhattan has, and so the two, working in harmony, can go on with a plan of expansion and development that would justify the Statue of Liberty at the entrance to the Harbor and win deserved admiration of the entire country.' "

Team-Track Occupation of Streets Without Compensation to City

It was the spirit of co-operation (" the blessing in disguise " of the New York Harbor Case) that led to the legislation under which our Commission was created. In urging the Legislature to pass this legislation, Governor Edge by special message of March 14, 1917, urged the creation of a " far-sighted interstate commission, which is oblivious to sectional prejudices and intent upon developing an important section of the country along broad lines."[76]

Governor Whitman, on March 12, 1917, addressing the Legislature of the State of New York and urging the adoption of the measure, said: "All but two of the trunk lines serving the Port of New York terminate in our neighboring State of New Jersey. This makes it essential that any solution of the Port Problem should include a study of that portion of the Port comprised within the northern part of New Jersey and, while it is beyond question that great benefits will accrue to the State of New York through a comprehensive Port policy, benefits will also accrue to New Jersey.

" I have been in conference with the State Engineer and Surveyor of New York and the Governor of New Jersey and they agree with me that it is imperative that both States should give immediate attention to this situation."

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[74] Record in New York Harbor Case. Brief in behalf of the State of New York, pp. 83-4.

[75] Record on New York Harbor Case, pp. 3393-4.

[76] From Governor Edge's special message to the legislature of New Jersey, accompanying the bill to create such a commission, March 14th, 1917.

The Interstate Commerce Commission took under consideration the fact that New York and New Jersey were thus co-operating to relieve the situation, saying, "in considering the situation here presented the Commission *cannot with propriety overlook* the fact that bills have been introduced in the legislatures of the states of New York and New Jersey providing for the appointment by the governors of those commonwealths of state commissions to study jointly the situation at the port and make appropriate recommendations, 'to the end that the said port shall be efficiently and constructively organized and furnished with modern * * * piers, rail and water and freight facilities, and adequately protected in the event of war.'"

Thus it came about through the travail of conflict that New York and New Jersey were brought together. In his message of February 18, 1918, Governor Whitman said:

"The recent decision of the Interstate Commerce Commission in the New York Harbor case has brought to the attention of the people of the two States, as never before, the important fact that *the Port of New York is historically, geographically, and commercially one port and that any congestion in the port at any one point affects the whole port.* While this port is undoubtedly the greatest port in the world and is at this very time performing a war service of incalculable value, its facilities have not been properly co-ordinated. Its size and complexity have led to serious and grave situations. The time has come to look forward and to plan in advance for the future demands that will be made upon the port. *Haphazard, piecemeal attempts to solve the terminal problem of the port will hinder, not hasten, the desired solution.* It is the universal opinion of all those who have studied the matter that there must be a careful, scientific study of *all* of the conditions at the port and a weighing and comparison *of the cost and value of all suggested improvements.* This cannot be done by any commission representing either State alone. *The task must be a joint task.*"

It was in these circumstances that our Commission was born. It faced another crisis in the relations between the states of New York and New Jersey. The history which we have here reviewed shows how prior to 1834 the relations between the two states became acute and how through litigations (the Passaic Valley Sewerage Case and the New York Harbor Case) those relations again became acute in 1916 and 1917. Intelligent study discloses that there was identity of interest and a duty to co-operate, and that while either one of the states might possibly prosper at the expense of the other, the long range judgment was indisputably that it was better to join hands; that "marriage" and not "divorce" was the proper course. As Governor Edge said at the 150th Anniversary of the Chamber of Commerce, April 5, 1918:

"We have, as your President inferred, many residents of New York, or at least men who are actively engaged in business in New York who, for some reason or another, prefer residence in New Jersey. We are very glad indeed to encourage them in every way to come to New York daily, contribute to your wonderful industrial, financial and commercial progress, and to return to New Jersey nightly, coming back the next morning revived by the delightful atmosphere and conditions of New Jersey, the home life, the associations, the environments, ready again for the coming of the new day, to assume their part of your and our responsibilities.

"When I became Governor I was presented with a legacy, which might perhaps have made it appear that New Jersey was suing for divorce from her sister State of New York. *I have been quite busy trying to re-establish family relations, and we have now reached that position, helped by the action and co-operation of Governor Whitman. We have established a partnership,* and I want to give due notice to the Chamber of Commerce of New York, that if this partnership does not continue and New York does not meet, which I am quite sure, however, New York will, its side of all these ambitious things we are attempting to bring about, then, sir, we are going to sue for a breach of promise."

Accordingly the Commission from the very beginning sought to bring about amicable relations between the two States.

Organization of the Commission

William R. Willcox, chairman, Eugenius H. Outerbridge and Arthur Curtiss James were the appointees to the New York commission. The three New Jersey signers of this joint report, J. Spencer Smith, DeWitt Van Buskirk and Frank R. Ford, were the original members of the New Jersey commission, Mr. Smith being designated as chairman. Acting in accordance with the legislation establishing them, the two commissions met August 1, 1917, as a Joint Commission and elected Mr. Willcox chairman and Mr. Smith vice-chairman.

Mr. James resigned December 31, 1918, owing to his intended absence in Europe in connection with the work of the American Committee for Relief in the Near East. Murray Hulbert, Commissioner of Docks of the City of New York, was appointed to succeed him. There have been no other changes in the personnel of the Commission.

Organized as a Joint Commission in August, 1917, the remainder of that year was devoted largely to planning the investigation. Maj.-Gen. George W. Goethals and B. F. Cresson, Jr., were retained as consulting engineer and chief engineer respectively, and Julius Henry Cohen as counsel. Executive offices were established at 115 Broadway, New York City, William Leary was employed as secretary and C. A. Ruhlmann as assistant secretary.

Early in 1918, in a "Preliminary Joint Report", the Commission expressed the belief that a period of two years and an expenditure of $400,000 would be required for the investigation. Acting in accordance with the recommendations of that report, the Legislature of each State appropriated $100,000 in 1918 and the same amount the following year. Before the Legislatures adjourned in 1920 it was apparent that somewhat more time and money would be needed than had been estimated to complete the Commission's investigation and print the report, and an additional sum of $25,000 was appropriated by each State.

PHYSICAL INVESTIGATION

The physical investigation was planned to follow three fundamental lines: (1) Study of existing conditions, (2) analysis of those conditions in terms of output and cost and (3) preparation of a comprehensive plan of development for the future. It was carried out mainly by four divisions — (1) the inspection force, which made the clockings of railroad, steamship, ferry and trucking operations, the subsequent computations and tabulations pertaining to them and the estimates of cost of new facilities; (2) the statistical force, which drew off from the carriers' records the basic figures it subsequently assembled into the statements of tonnages and costs of present operations presented in this report; (3) a group of special engineers employed for certain of the incidental studies, such as those of market and food distribution, freight-handling machinery, water supply and other subjects treated in subsequent chapters; and (4) a corps of draftsmen to make the maps and drawings.

The work of the inspection and statistical forces is described in some detail in Chapters 6 and 7 and other chapters. The engineering force reached a maximum of seventy persons.

The work of the engineering office was carried on under the direction, subject to review by the Commission and its consulting engineer, of an executive engineering staff consisting of B. F. Cresson, Jr., chief engineer; W. W. Drinker, terminal engineer, formerly principal assistant engineer of the Erie Railroad; J. E. Ramsey, chief statistician, previously assistant to the comptroller of The Delaware and Hudson Company; and C. W. Stark, engineering editor, formerly railroad editor of the *Engineering News-Record.* Robert A. Lesher, previously secretary and engineering assistant to the board created by the War Department to appraise the Bush Terminal in New York, was employed to study shipping conditions. M. W. Williams, consulting engineer, was retained to study various matters relating to water terminals and inland waterways. Edward Wegmann, consulting engineer, made an investigation of water supply for the Port and assisted in the Commission's tunnel estimates. Francis P. Sloan, formerly in the service of the New York City Plan Commission, was employed on various assignments. Edward J. Tschimbke was chief clerk in charge of the records and accounts of the engineering office.

The engineering office was maintained at 14 John Street, New York, until May 1, 1920. Since then, through the courtesy of the Chamber of Commerce of the State of New York, it has been housed at 2 Liberty Place, in the building owned by that body.

OTHER ACTIVITIES OF COMMISSION

The history of the evolution and development of the proposed compact or agreement between the two States, as well as the legal basis therefor, is to be found in Part III of this report.

During the three years of its existence the Commission has held meetings at frequent intervals, usually weekly but more often when the occasion demanded. Public officials, representatives of commercial organizations and the advocates of specific plans for port development have been invited to appear before the Commission, and the Commission has sought diligently to learn the views of those best versed in the port problem from its various angles. Inspection trips have been made, and at the Commission's offices have been gathered an extensive file of books, periodicals, general and special reports, maps and other data bearing upon the port problem.

WAR BOARD FOR THE PORT OF NEW YORK

Early in its existence, while the country was at war, the Commission had an opportunity to be of service in the emergency administration of the Port. On September 19, 1917, the then Governors of New York and New Jersey, Hon. Charles S. Whitman and Hon. Walter E. Edge, together with representatives of the United States War Department, the State Engineer and Surveyor of New York State and the Dock Commissioner of the City of New York accompanied the Commission on a complete tour of inspection of the harbor facilities of the Port. Immediately following this inspection both Governors addressed the chairman of the Commission urging him to call upon President Wilson and tender the service of the two States in the operation of the Port of New York as a war agency.

On October 3, at the President's request, the Commission held a conference with him at which he approved of the creation of a joint authority combining both Federal and State authority for the use of the Port during the war. At the instance of the President a conference was held October 22, at the office of the Secretary of War, at which were present the Secretary of War; Generals Black and Abbott; Admiral Benson, representing the Secretary of the Navy; the Secretary of Commerce; the chairman of the United States Shipping Board, and the members of this Commission. At an adjourned meeting at the office of the Commission, November 3, 1917, at which Hon. Byron R. Newton, collector of customs at the Port of New York, represented the Treasury Department, the War Board for the Port of New York was created. Hon. William G. McAdoo, Secretary of the Treasury, was elected as chairman, Mr. Willcox of this Commission was elected vice-chairman and Mr. Cohen, counsel for the Commission, was elected secretary. Secretary McAdoo subsequently resigned as chairman because of the pressure of other duties, and Mr. Hurley, chairman of the Shipping Board, was elected in his place. Mr. Irving T. Bush was chosen as chief executive officer.

This War Board for the Port of New York represented the first successful co-ordination in a single body of all possessing authority in the Port, and is believed to have been a working agency of great value in the prosecution of the war. It continued in conjunction with the United States Shipping Board until this Department created in February, 1918, the Shipping Control Committee, which took charge of the work.

The Commission actively co-operated with the War Board during its existence, assisting the Federal Government in obtaining the use of, in connection with supplying the army overseas, the Hoboken docks, certain Hudson River piers in Manhattan, the Bush Terminal and other facilities, and their co-ordination by rail and water facilities.

Acknowledgments

The Commission has already referred to its invitations to those interested in the port problem to appear before it. During the first year of its work, when the Commission was reviewing what had been done by other bodies studying the problem and seeking suggestions as to what could be done, many of these conferences were held — with railroad executives and their traffic officials, with steamship agents, representatives of lighterage companies, trucking companies, warehousing interests, committees of commercial organizations, manufacturers of various types of freight-handling machinery, and engineers known to have studied or suggested various terminal developments in this or other ports. A number of these conferences were of a prolonged nature, and not a few required considerable advance preparation of plans, statistics and argumentative material by those invited to confer with the Commission.

In all of these cases, the Commission is glad to state, it met the heartiest and most unselfish co-operation. The list of persons and organizations involved is perhaps too long to be completely reviewed here. The Commission desires, however, to make special acknowledgment to many who unselfishly devoted much time and effort to assisting in these conferences.

In the matter of legislation, consideration of the Commission's progress reports and assistance from public officials, special acknowledgment is due to Hon. Chas. S. Whitman, former Governor of the State of New York, and Hon. Walter E. Edge, former Governor of the State of New Jersey, who were in office when the Commission was created; Hon. Alfred E. Smith, Governor of the State of New York, who, throughout his administration, has recognized the importance of the Commission's work, has given repeated evidence of his sympathy therewith and has devoted much time and effort both with the members of the Commission and with the local and legislative authorities to secure full consideration of the Commission's proposals; to the legislative leaders of both the Republican and Democratic parties, the Attorneys General of the two States, the Corporation Counsels of the cities of New York and Jersey City, and the members of the subcommittee of the Bi-State Legislative Committee, who, at much personal inconvenience, gave an immense amount of time to the study of the proposed compact between the two States and the revision thereof.

Three-Track Car Float Receiving Load at Transfer Bridge in New Jersey

In the physical investigation material aid was given to the Commission and its engineers in

(a) ascertaining and determining the facts relative to the present terminal methods and costs at the Port of New York,

(b) examining the plans and studying the views and suggestions of other students of the port problem,

(c) developing in a practical manner the operating details of the plans and suggestions emanating from the Commission and its staff, and

(d) keeping the business community and public at large as informed and interested as might be possible during the progress of the Commission's work.

The Commission desires to extend its heartiest acknowledgments and thanks to the following organizations and individuals who contributed such aid, and while space does not permit of greater detail here, the Commission gladly states that it would have been very difficult to have attained the desired ends without the helpful and generous co-operation and assistance of these organizations and individuals:

The executives, officials and representatives of each of the railroad lines entering the Port, and the United States Railroad Administration which had charge of the railroads during the greater part of the investigation, for giving members of the Commission's organization free access to the yards and terminals and also to the books and records in the various railroad offices.

Representatives and officials of various steamship lines, for permitting the Commission's forces to enter upon their piers and ships and make clockings of the discharging and loading operations, and also for permitting them to draw off certain information from the book records.

The United States Custom House officials in New York City for permitting representatives of the Commission to examine and draw off records of shipping entrances and clearances at the Port of New York.

The New York Dock Company, and Mr. William E. Halm, president of the company, for permitting the Commission's forces to examine the company's books and records of shipping and warehousing operations.

The Bush Terminal Company for extending the Commission the same courtesy, and Mr. Irving T. Bush, president of that company, for giving the Commission access to field notes and estimates covering the survey made some years ago under his direction for an exterior belt-line railroad in New Jersey.

The General Electric Company, for conferences and co-operation in developing the automatic-electric system and working out details of the operation of this system — the electric features, the character of the equipment and the estimates of cost. Mr. James A. Jackson of the Power and Mining Engineering Department worked with the Commission's engineering staff for a period of weeks in developing these details, and Mr. David B. Rushmore, chief engineer of the company, Mr. R. H. McLain, section head of the Power and Mining Engineering Department, and Messrs. C. A. Rohr and F. S. Hartman, of the New York office, also gave much time and thought to the problem, and the Commission desires to express its appreciation of their individual efforts as well as of the co-operation of the company they serve.

Mr. F. H. Shepard, director of heavy traction, the Westinghouse Electric & Manufacturing Company, for reviewing the plans for the automatic-electric system and giving advice as to its feasibility.

The Otis Elevator Company, through its representatives, Mr. David Lindquist, chief engineer, Mr. A. E. Handy, assistant manager of the special sales department, and Mr. R. W. Scott, for advice relative to the special elevators for the automatic-electric system, given in a series of conferences.

Mr. B. F. Fitch, President of the Motor Terminals Company, for co-operation with the Commission in the analysis of the operation of the special motor-truck service contemplated to handle freight within the Port District.

The Alvey-Ferguson Company, Inc., for drawings covering a cableway truck-conveyor freight handling system prepared in considerable detail and presented to the Commission through the company's representatives, Mr. M. U. Burnham, president, Mr. E. Palmer Burnham, vice-president, and Mr. J. C. Walter, Eastern sales manager.

Dr. Gustav Lindenthal for information as to the cost and feasibility of a bridge over the Hudson River.

The engineers of the Transit Construction Commission of New York, for information as to costs of subway and tunnel construction.

The Interborough Rapid Transit Company, for information relative to the maintenance of its lines and tracks, and the cost of power.

The State Engineer and Surveyor of the State of New York, for aid and co-operation in supplying the organization and directing the survey for the outer belt-line railroad in New Jersey incorporated in the comprehensive plan recommended by the Commission, and for supplying other information.

The Department of Docks of the City of New York.

The Board of Commerce and Navigation of the State of New Jersey for maps and information relative to the physical conditions, and for historical information.

The district engineers of the United States Army, for permitting representatives of the Commission to examine the tonnage statistics compiled in that office.

The United States Shipping Board, for supplying certain statistics concerning the operation of the Port of New York.

The United States Bureau of the Census, for supplying the Commission direct with statistics as to the recent census.

The United States Fuel Administration and the New York and New Jersey fuel administrators, for information as to the movement of fuel.

The New York State Department of Farms and Markets, for information concerning market conditions.

The New York Produce Exchange, representatives of the grain interests, and the Montreal Board of Trade for information relative to the movement of grain.

The Chamber of Commerce of the State of New York, which opened its hospitable doors for luncheon meetings, public discussions and conferences, and generously co-operated with suggestions, criticisms and helpfulness even to the extent of putting at the service of the Commission, free of rent, the use of space in its building for the work of the engineering department at a time when space was unobtainable elsewhere. Without disparagement to such organizations as the City Club, the Citizens' Union, the Merchants' Association, the Hudson Valley Federated Chambers of Commerce, the Newark, Jersey City and Bayonne Boards of Trade, all of whom gave valuable help to the Commission, the Commission must nevertheless make special acknowledgment to the Chamber of Commerce of the State of New York for unusual and generous support and co-operation throughout, with no attempt at any time unduly to impress upon the Commission its own views.

The Transportation Engineering Committee of the National Electric Light Association, for conferences relative to electric trucks for handling freight.

The Material Handling Machinery Manufacturers' Association, for conferences and information relative to the latest cargo-handling machinery.

Commercial organizations, for conferences and information concerning the local conditions and needs.

Market organizations in New York City and other cities throughout the country, for information as to the conditions and operations in the handling of food.

Warehousing organizations, gas, electric light and power companies, water companies, public officials in charge of water supply, trucking companies, lighterage companies, stevedoring and longshoremen's associations, certain private interests conducting extensive trucking operations, and real-estate associations, for conferences, information and suggestions regarding conditions and operations within the Port District.

CHAPTER 2

Geography of the Port

Both physically and politically the Port of New York is divided into a large number of component parts. The physical divisions, caused in the main as they are by the numerous bays, rivers and other waterways, are a concomitant of the natural selection of a district so well provided with navigable waters for the development of the first port in the land; but the cutting up of the district into so many parts introduces large problems to make the Port function as a unit. Politically there are still more subdivisions, and this fact does not contribute in any way to the development of the Port, but impedes that development. It is hoped that the creation of a port district and a port authority will go far toward removing that impediment.

Both physically and politically the district is first cut in half by its principal waterway, the Hudson River and the Upper New York Bay, the division line turning west through the Kill von Kull and Arthur Kill and so throwing Staten Island on the east side. Physically this line sets off the western section, one of four principal sections of the port; politically it separates New Jersey from New York. Physically the other three principal sections are the central section, comprising Manhattan, the Bronx and part of Westchester County; the eastern section, comprising Brooklyn and Queens, or the western end of Long Island, and the southern section, formed by Staten Island. The four sections, but particularly the western, are further subdivided by numerous lesser waterways and land formations. Politically, also, the two major sections are subdivided — on the east or New York side into the five boroughs of New York City, whose interests are not identical, and into several important communities north of New York City — on the west or New Jersey side into some forty cities and towns.

Physical Geography of the Port

Manhattan Island, from whatever point of view, physical, political or commercial, may be considered the center or focal point of the Port.

MANHATTAN

Manhattan consists of a strip of land about thirteen miles long and for the most part slightly more than two miles wide, running north-northeast and south-southwest. At the north end, for a length of three or four miles, it is narrowed to less than a mile in width. At the south end it is brought to a point by the junction of the Hudson and East Rivers.

Manhattan is bounded principally by these two rivers — the Hudson River on the west and the East River on the east. At the north end the island is cut off from the mainland beyond it by a narrow tidal waterway connecting the two rivers. Originally this waterway was fairly near straight for the greater part of its length, and that part received the name of the Harlem River; but near the Hudson River end it encountered a tidal marsh, and the outlet to the Hudson, which was tortuous, and narrow in places, became known as Spuyten Duyvil Creek. In 1888–1895 a half-mile ship canal was cut through to eliminate some of the windings, and now the entire channel from the East River to the Hudson appears as a continuous waterway. The original connection has been filled.

That part of the Hudson River opposite New York City is commonly known as the North River. New York City piers on the Hudson River are designated by the abbreviation "N. R." "H. R." indicates Harlem River piers, and "E. R.", "S. I.", "S. B.", "J. B." and "F. B." indicate piers on the East River, Staten Island, South Brooklyn, Jamaica Bay and Flushing Bay respectively.

Of these tidal and navigable waters surrounding Manhattan, the Hudson River on the west is nearly straight and approximately a mile wide for the entire length of Manhattan. The Harlem River, Spuyten Duyvil Creek and the ship canal are uniformly a few hundred feet wide. The East River requires more detailed description.

East River — Starting at the junction with the Hudson at the lower end of Manhattan, the East River extends northeasterly, with an average width of a third of a mile, for a distance of some two miles. Here it turns nearly a right angle to the left, around a point on Manhattan called Corlears Hook, and proceeds virtually parallel with the Hudson. It then widens to more than half a mile, but in the upper reaches is divided by islands. The first of these is Blackwell's Island, a strip of land 1¾ miles long and 600 ft. wide, in midstream, the south end three miles above Corlears Hook. Halletts Point, projecting from the Long Island side just beyond Blackwell's Island, narrows the river to a quarter of a mile. Immediately it widens again to a mile, but the effective waterway is reduced to smaller proportions by Ward's and Randall's Islands, which force vessels to make a sharp reverse curve between Ward's Island and Long Island, through a passage less than 1000 ft. wide known as Hell Gate because of its dangerous rocks and treacherous currents. The still narrower Little Hell Gate, between Ward's and Randall's Islands, is not commercially navigable. Ward's Island is roughly 3000 ft. square. Randall's Island is triangular, about 3000 ft. to a side.

Separating Randall's Island from the mainland is a shallow strait known as the Bronx Kills. At the mouth of the Harlem the East River turns eastward, becomes much wider, and ultimately merges into Long Island Sound.

Of these waters surrounding Manhattan, only the

Hudson is correctly speaking a river. The others are straits, flowing in either direction according to the tides. Even the Hudson is salt water a considerable distance above Manhattan.

Topography of Manhattan—Beginning not quite halfway up Manhattan, in the vicinity of what is now Seventy-second Street, the ground rises rather abruptly from the Hudson River to an elevation of about 60 ft. This ground becomes higher to the north, at the same time narrowing to a ridge about three-quarters of a mile wide, and in places more than 200 ft. high. The ridge takes definite shape at about 110th Street and extends to Spuyten Duyvil, broken only by Manhattan valley and Inwood valley, low places perhaps 1000 ft. wide crossing the island at 128th Street and Dyckman (200th) Street. Except for the low crossing at Inwood, the upper three miles of the island are precipitous to the water's edge of both the Hudson and the Harlem rivers.

Other parts of the island are more or less hilly, but the lower section is fairly flat, rising on easy grades from the rivers.

Much of the waterfront is made ground for a width in places of a third of a mile inland, reclaimed by the filling of the original marshes and the mouths of the numerous tributary creeks, all of which have been absorbed in the sewer system. As thus filled in the waterfront is quite regular and there are no indentations or projections of any importance, other than at turns and junctions of the boundary waterways.

THE BRONX AND WESTCHESTER COUNTY

Completing the central section of the Port is the territory north of the Harlem River, which tapers at the south end to the width of Manhattan, but spreads out to the north because of the turning of the East River eastward into Long Island Sound.

The west side of this area is high and rugged, rising for the most part abruptly from the Hudson, but cut by a few watercourses, none of them tidal for any distance, discharging into the Hudson. The chief of these within the Port District is the Sawmill River at Yonkers, also called the Nepperhan River. The Hudson waterfront is mostly even, and dockage has been afforded only by building into the river, where good depths were easily obtained.

The east and south frontage of the area on the East River and Long Island Sound is mostly low and very irregular, with alternating bays and points shown on the map more clearly than they can be defined. Although the East River expands considerably as soon as Randall's Island is passed, the numerous projections from both the Bronx and the Long Island shore result in several places where the waterway is considerably less than a mile wide, and not until Throgs Neck, the termination of a long point seven miles from Randall's Island, is passed does the waterway take the name of Long Island Sound. In this section of the river are the Sunken Meadows, North Brother Island, South Brother Island and Riker's Island, all within one or two miles of Randall's Island.

Long Island Sound is similar to these seven miles of the East River, but wider.

In the main the land fronting the East River and the Sound is low. The tributary streams, of which the Bronx River, Westchester Creek and Eastchester Creek are the principal ones, are tidal for two or three miles and are flanked by marshes.

The interior of this part of the so-called central district is cut with ridges and valleys running in a general way parallel with the Hudson. The chief of these valleys is that of the Bronx River, which rises beyond the limits of the Port District and lies about three miles east of the Hudson. The ridges rise to upward of 300 ft. in height west of the Bronx River.

The Bronx waterfront of the Harlem River is regular, affording only limited space for dockage, and the ground rises steeply except at the south end.

EASTERN OR LONG ISLAND SECTION

Long Island, the western end of which comprises the eastern section of the Port, extends nearly eastward from the East River and the Upper Bay for a distance of about 120 miles, being separated from the State of Connecticut by Long Island Sound. The western end of the island is about fifteen miles wide and terminates bluntly; its shore closely parallels that of Manhattan from the mouth of the Bronx Kills, forming the east bank of the East River, a distance of about eight miles, and continues in the same general direction about six miles farther as the east waterfront of the Upper Bay to the Narrows, where it curves southward and swings into the long stretches of beach along the south part of the island.

In general Long Island is somewhat hilly on the north side, with deep bays and promontories alternating, while the south side is low and marshy, with large but shallow bays closed in by the above-mentioned long narrow strips of beach. These characteristics prevail at the eastern extremities of the Port District, but toward the western end of the island they are less distinguishable.

The Long Island waterfront is mostly irregular, even opposite the unbroken shore of Manhattan. Opposite Corlears Hook is an indentation called Wallabout Bay, on which is located the New York Navy Yard. Two miles to the north is the mouth of Newtown Creek, a tidewater inlet about 200 ft. wide which can be navigated southeastward for some three miles. Around the turn into Long Island Sound are Flushing Bay and Little Neck Bay, each of which extends inland two miles or so, while Flushing Bay has a tributary tidal inlet for several miles in Flushing Creek.

Two and one-half miles to the south of the tip of Manhattan is a good-sized indentation known as Gowanus Bay, from which a tidal waterway navigable for small craft, known as the Gowanus Canal, extends northeast somewhat more than a mile.

Just beyond the Narrows, at the southwest curve of Long Island, is a large bay called Gravesend Bay. This is separated from the Lower New York Bay at the south by the most westerly of the previously mentioned strips of beach, Coney Island. Coney Island, a stretch of low land five miles long, varying from three-quarters of a mile wide to a few hundred feet, is an island only by virtue of a narrow and sinuous tidal waterway, Coney Island Creek, which, until the east end was filled, connected Gravesend with Sheepshead Bay, the latter being a much smaller body of water behind the east end of Coney Island.

Jamaica Bay—Just beyond Coney Island is Jamaica Bay, which is much the largest indentation in Long Island within the Port District. Jamaica Bay is roughly semi-circular, with a radius of about four miles. It is closed in on the south by Rockaway Beach, the second of the strips of low beach, the west end of which nearly overlaps the east end of Coney Island and forms the only entrance to Jamaica Bay, Rockaway Inlet, a strait about a mile wide and two miles long, leading in from the west. Jamaica Bay is at present generally shallow, and contains numerous islands, the majority of which are submerged at high tide. It also has numerous small tidal inlets and an irregular shore line. Rockaway Beach gives it excellent protection, although its entrance is from the Atlantic Ocean proper.

All of the ground around Jamaica Bay and Coney Island is very low—only a few feet above sea level. North from the narrows the topography of the Long Island section takes more the character of lower Manhattan—sloping easily upward from the river and reaching fairly high ground (El. 150) at certain points well back from the waterfront. Along the mouth of the East River for a distance of about a mile, and for a somewhat greater length in the vicinity of the Narrows, the ground rises abruptly to a height of perhaps 70 ft. above the water level.

STATEN ISLAND

Staten Island, the southern section of the Port, has its axis virtually in line with that of Manhattan, the north end of the island being five miles from the south end of Manhattan. The island is only slightly longer than Manhattan but has more than double the area, for the reason that it is eight miles wide near the north end. It is separated from the mainland of New Jersey by the Arthur Kill, a crooked waterway about eleven miles long, about 1,000 ft. wide at the north end and half a mile at the south end; and from the Bayonne peninsula by the Kill van Kull, a waterway three miles long and averaging about one-third of a mile wide. It is separated from Brooklyn by the Narrows, a strait a mile wide and slightly more than a mile long, connecting the Upper and Lower Bays.

Staten Island rises rather steeply at the north end to a height in one or two places of 200 ft. or so. These hills range themselves into a ridge which runs the long way of the island considerably to the east of the center and disappears at the south end. The west side of the island is low and is deeply indented at about the midpoint by the tidewater inlet known as the Fresh Kills.

Aside from the Fresh Kills and an indentation opposite on the Lower Bay similar to Gravesend Bay but much smaller, and known as the Great Kills, the waterfront of Staten Island is fairly regular, and there are no important inlets or projections.

PALISADES AND BERGEN HILL

In extent and area the western section, comprising all of the remainder of the Port and all of the territory within the State of New Jersey, is much larger than any of the other three.

At Piermont, about twenty-five miles up the Hudson from the lower end of Manhattan, and three miles beyond the State line in New York, there is a deep cleft in the west bank of the Hudson, where Sparkill Creek flows through. Beginning just south of that point the bank rises precipitously in what is known as the Palisades, a cliff from 300 to 500 ft. high, nearly vertical at the top in many places. This cliff, the base of which is nowhere more than a few hundred feet from the water's edge, extends southward to a point about four miles above the south end of Manhattan. The hill is in general approximately flat on top for a width of about a mile, and then it slopes downward rather steeply to other drainage approximately parallel with the Hudson.

At the above mentioned point four miles above the south end of Manhattan, in what is now Weehawken, the eastern base of the cliff turns in from the river and back to a position nearly parallel with it and about a mile inland. The hill, which is here known as Bergen Hill, is still about a mile wide; it is at this point only about 200 ft. above sea level and its eastern base has become less precipitous, but its western base has become steeper, so that it still forms a barrier to east-and-west traffic. The ridge, gradually becoming lower, continues to the south and forms the Bayonne peninsula. The ground to the east of the ridge below Weehawken is mostly only a few feet above sea level. An exception is an abrupt knoll at the water's edge in what is now Hoboken. The knoll is on what is called Castle Point.

BAYONNE PENINSULA

The Bayonne peninsula forms the west boundary of the Upper New York Bay, as well as the east boundary of Newark Bay. Beginning opposite the south end of Manhattan, where the shore line turns west to the higher ground of the peninsula, the peninsula is about six miles long. For two miles it is less than three-fourths of a mile wide, but at the south end it broadens out by a projection to the east known as Constable Hook, the end of which is two miles from the west side of the peninsula. The south end of the peninsula is called Bergen Point.

From Bergen Point to Constable Hook, about three miles, the face of the peninsula forms the north side of Kill van Kull and closely parallels the curves of the Staten Island shore.

UPPER BAY

Manhattan, Brooklyn, Staten Island and the Bayonne peninsula, parts of the four main physical sections of the Port, define the Upper Bay, an elliptical basin about five miles long and four miles wide, the long dimension being from Manhattan to Staten Island. An arm of the bay east of Staten Island becomes the Narrows. In the bay are three small islands—Governor's, Ellis and Bedloe's. A fourth, Black Tom, has been made a peninsula by filling out from the New Jersey shore. Ellis and Bedloe's Islands are west of the axis of the Hudson. Governor's Island, which is considerably larger than the other two, is east of the axis of the Hudson, at the entrance to the East River. The passageway between it and Long Island, which passageway is only about a quarter of a mile wide, is called Buttermilk Channel.

As Manhattan is the land center of the Port District, so the Upper Bay can be considered the central and focal body of water. From it lead waterways to the south, north and west, to the outer sea and to the narrower inland waters.

EAST JERSEY WATERFRONT

Returning to the New Jersey land section, or that part of it fronting the waters described, we find that from Piermont south to Fort Lee, up the west bank of the Hudson some ten miles from its mouth to the south end of Manhattan, the shore line is regular, and the precipitous nature of the Palisades precludes any extensive industrial or commercial use of the waterfront. The waterfront has been set aside by the two States as the Interstate Palisades Park.

From Fort Lee to Weehawken there is a little more low ground in front of the cliff, and this is being utilized; but the waterfront is nearly as even as farther up the river. South of Weehawken the shore line is somewhat more irregular and there are a number of small bays. One of these is known as Harsimus Cove; another, extending a mile inland, as the Morris Canal Basin.

NEWARK BAY

West of the Bayonne peninsula and parallel with it is Newark Bay, a body of water about six miles long and one and one-half miles wide. It has two outlets, one to the east through Kill van Kull into the Upper New York Bay and the other a more devious one to the south through the Arthur Kill into the arm of the Lower Bay known as Raritan Bay. It has two main inlets at the north, the Hackensack and Passaic Rivers.

The east shore line of Newark Bay is regular and the ground rises rather abruptly to a height of from 20 to 40 ft. The west side and the north end between the mouths of the two rivers is marshy, the marsh extending westward from one to three miles.

JERSEY, HACKENSACK OR BERGEN MEADOWS

The low area occupied by Newark Bay and the marsh west of it continues northward for ten miles or more in what is variously known as the Jersey, Hackensack or Bergen Meadows, a section four miles wide and for the most part only slightly above mean tide, running from Bergen Hill to other high ground west of the meadows. The Hackensack River winds through about the center of the meadows for their entire length, and numerous tributary creeks cut through it in every direction.

The drainage problem of this meadow land has thus far been an effective barrier to its development. except for railroad yards and a limited number of industries.

East of the Hackensack the ground rises above the general level of the Meadows in two or three low hills, and one knoll called Snake Hill rises quite sharply to some 80 ft. above sea level.

HACKENSACK RIVER

The Hackensack River, the more easterly of the tributaries of Newark Bay, is a waterway about 1,000 ft. wide in its lower reaches, running roughly parallel with the Hudson River and from three to six miles from it. It is tidal for a distance of about fourteen miles, and near the upper end of the tidal section is a branch to the eastward known as Overpeck Creek, which is also tidal for about three miles. This inlet is about two and one-half miles from the Hudson. A smaller tidal tributary, Berry's Creek, lies in the meadows west of the Hackensack, and flows into the latter about six miles above its mouth.

Rising some ten miles north of Piermont, the Hackensack River is at no point far from the Hudson River. In its lower reaches Bergen Hill is the only ridge between the two rivers. Farther up the ground becomes more broken as the summits become higher; but the entire valley of the Hackensack and its tributaries remains much lower than the Palisades ridge, and the drainage is toward the Hackensack up to Sparkill Creek. The headwaters of this latter stream, which as previously stated flows into the Hudson at Piermont, are less than a quarter of a mile from a branch of the Hackensack, at a point less than 30 ft. above sea level. There are geological indications that at one time the two streams were connected.

PASSAIC RIVER

The Passaic River is somewhat narrower and considerably more devious than the Hackensack, though draining a larger area. It rises almost due west from the lower extremity of Manhattan and about thirty miles therefrom, and first flows south about ten miles, to a point almost due west from the tip of the Bayonne peninsula and about twenty miles from it. It then turns sharply to the left and flows in a northeasterly direction nearly parallel with the Hudson River, but in the opposite direction, to a point twenty miles due north of the tip of the Bayonne peninsula and twelve miles west of the Hudson, in the northern part of what is now the city of Paterson. Here it turns sharply again, to the right this time, and flows in a generally southerly direction into Newark Bay. It does not enter the Hackensack Meadows at the north end, as does the Hackensack River, but remains from one to two miles west thereof, separated by a low ridge (about 140 ft. high) until it is nearly opposite the north end of Newark Bay and three miles to the west. Here it makes a broad double turn into the meadows and thence into the bay.

The Passaic River is tidal for a distance of about fourteen miles. Except for the first four miles or so it is flanked by fairly substantial ground, which in a few places rises rather abruptly. Near the turn in Paterson there is a fall of about 70 ft., known as the Passaic Falls, and six miles farther up is a much smaller one known as Little Falls. Beyond Little Falls are numerous tributaries, mostly from the north.

At the Paterson turn the Passaic is about six miles from the Hackensack. About midway between the two is the Saddle River, which flows almost due south from the State line and enters the Passaic about six miles below the Paterson turn.

The country between the Passaic and the Hackensack north of the meadows is gently rolling, reaching a height of more than 100 ft. above sea level at only a few points. Farther to the north it becomes more rugged, the ridges being generally parallel with the Hudson.

ORANGE-WATCHUNG RANGE

The sharp turn in the Passaic River at Paterson marks the approximate point where the river breaks through a ridge running approximately parallel with the Hudson River and about twelve miles west of it, and continuing in the same general direction to a point opposite the lower end of Staten Island, where it sweeps around to the northwest, well beyond the limits of the Port District. North of Paterson the ridge loses its identity in the rugged country of that region. South of Paterson it takes rather definite shape in what opposite the Hackensack Meadows is called the Orange Mountains, and what farther to the south, beyond the point where the Rahway River breaks through, is called the Watchung Range.

For a depth of about three miles the tongue of land occupied by the city of Paterson is fairly low — about 100 ft. above sea level. Then the ridge rises sharply to a height of nearly 600 ft. and continues at about that average height some fourteen miles, to the Rahway River cleft. There are other hills west of the main range, and in the neighborhood of the cities of Montclair and Orange the range is nearly five miles wide, presenting a formidable barrier to east-and-west transportation. The only break is the rather high cleft at Great Notch, three miles from Paterson.

West of the Orange Mountains flows the Passaic River at an elevation of about 160 ft. above sea level, largely in marshy ground. Seven miles or so above Paterson the valley widens into a fresh water marsh six miles long and half as wide. Beyond the marshes through which the river flows the ground becomes increasingly rugged.

The break in the Orange-Watchung range caused by the Rahway River is about one and one-half miles wide and 380 ft. above sea level at its lowest point. This pass leads directly to the Passaic valley and the valleys of its tributaries from the northwest.

South of this break the Watchung range splits into two parallel ridges called the First and Second Watchung Mountains. The tops of the ridges are about one and one-half miles apart. The first mountain is about 500 ft. high; the second slightly higher; the intervening valley from 200 to 300 ft. above sea level. The ridges continue nearly straight, with only a few narrow breaks, for about fourteen miles beyond the Rahway cleft, where, at a point close to the Raritan River, they make the wide turn previously mentioned to the northwest.

FOREGROUND OF ORANGE-WATCHUNG RANGE — RAHWAY RIVER DISTRICT

From the base of the Orange Mountains the ground slopes gently for the most part to the Passaic River, from an average elevation of about 200 ft. The slope is steep, but not intolerably so, for railroads. About the same slopes prevail down to the marshes along Newark Bay. Farther south, as the larger streams flowing into the Arthur Kill are approached, the ground becomes lower.

Three principal rivers flow into the Arthur Kill, the Elizabeth, Rahway and Woodbridge Rivers. The first and last named are of less importance than the other, but are tidal for two or three miles inland. The Rahway River is 500 ft. wide at its mouth and is tidal for four miles inland, where it breaks into several branches. The main part of the river rises in the Orange Mountains and follows a shallow valley in a southerly direction to tidewater.

All of these rivers at the lower ends are flanked with marshes. In fact, the greater part of the west bank of the Arthur Kill is marshy, and there are numerous small tidal inlets. The ground just north of the Rahway River at its mouth is somewhat higher, and is called Tremley Point.

RARITAN BAY AND RIVER

Lower New York Bay terminates south of Staten Island in what is called Raritan Bay, into which, besides the Arthur Kill, flows the Raritan River. The mouth of the Raritan River is a bay four miles long and from one-half to three-fourths of a mile wide, with a double turn affording protection from heavy seas. At this four-mile point the river narrows to a crooked stream less than 1,000 ft. wide, which, however, is tidal for a distance of about four miles in a straight line, or probably six following the river.

West of this point the river, with its various branches and tributaries, comes from an area immediately south and southwest of the watershed of the Passaic River. One tributary, the Millstone River, rises almost due south of the mouth of the Raritan River and flowing west and north empties into the Raritan fifteen miles west of its mouth, following a valley that has been utilized by a canal connecting the Raritan and Delaware Rivers.

Another tributary nearer the mouth of the Raritan is South River, which empties into the Raritan from the south in its tidal section, and is itself tidal for two or three miles. The greater part of the ground adjoining all of this tidal water, which includes one or two other small tributaries to the Raritan from the south, is marshy. At the very mouth of the Raritan, however, particularly on the point formed between the river and Arthur Kill, the ground is higher and virtually free from marshes.

SOUTH MARGIN OF LOWER BAY

The south margin of Raritan Bay, the Lower Bay and Sandy Hook Bay, together with the strip of beach known as Sandy Hook, which projects north about five miles and makes the gateway into New York Harbor, completes what the Commission considers the Port District. This margin is marshy along the tidal inlets, of which Cheesequake Creek and Matawan Creek are of some importance, while between the marshy sections the ground is higher. Near the base of Sandy Hook the mainland rises abruptly to a height of more than 200 ft. in what is called Atlantic Highlands.

Sandy Hook is similar to the beaches described on the south shore of Long Island. It is nowhere more than fifteen feet above sea level. In places it is nearly a mile wide, but the south end narrows to a neck only a few hundred feet wide, a neck which does not join the main line at Atlantic Highlands, but is separated therefrom by the tidal mouths of the Navesink and Shrewsbury Rivers, which, flowing northeasterly, discharge into Sandy Hook Bay, passing through a strait perhaps 300 ft. wide. These rivers are not considered within the Port District.

NAVIGABLE WATERS OF THE PORT

Considering the physical characteristics of the Port District from the viewpoint of navigable waters, it would be desirable to see those waters as Hendrick Hudson might have seen them, since the early conditions are what attracted the traders who gave the Port its original impetus, and who depended almost entirely on water transportation. Because of the large amount of dredging of channels and reclaiming of marsh land that has been done, this is hardly possible at this late date. We can therefore only outline the picture. Details of these waters as they are now are presented in Chapter 24 on "Channel Improvement."

In the early days the colonists probably found the Lower Bay, the Narrows, the well-sheltered Upper Bay and the mouths of the Hudson and East Rivers amply deep, but shoals on the New Jersey side of the Upper Bay and the Hudson helped influence them to choose the New York side. Raritan Bay, the Kill van Kull, Newark Bay and the Arthur Kill were not so deep as the first group of waters, but deep enough no doubt to be negotiated under favorable tides and winds. The Raritan, Rahway, Passaic and Hackensack Rivers, Gowanus Creek, Newtown Creek, Harlem River, Bronx River, Jamaica Bay and its inlets, and scores of other tidal streams large enough for the small craft of those days augmented the total.

In all there were about 800 miles of waterfront within the district. Everywhere the land was within a few miles at most of some form of navigable water. The narrowness of the islands and peninsulas, while it complicates the present-day problem and makes it difficult to prevent congestion, must have made a strong appeal in the early days, because it meant short land hauls. And in addition to these local waters and the outlet to the sea, the Hudson River provided an avenue for water commerce for a distance to the north of 150 miles, while Long Island Sound afforded a protected approach to the New England district.

TIDAL CONDITIONS

Because of the separate entrances to New York Harbor through the Lower Bay and Long Island Sound, and because of the several interconnecting waterways within the harbor, the tidal conditions at the Port are complex. High tide at the south end of Manhattan Island and at Throgs Neck are several hours apart, as in the case of the two ends of the Harlem River. Consequently there are strong currents in the East and Harlem Rivers, sometimes in one direction, sometimes in the other.

The tidal range, also, is considerably more in some parts of the harbor than in others. Throughout the harbor, however, it is small as compared with many other ports, averaging only about 4½ ft. With the possible exception of a few of the largest passenger steamers, sailings may be made irrespective of the state of the tide. This is quite impossible at London or Liverpool, for example, where tidal ranges of 18 and 26 ft. respectively make it necessary for vessels as a rule to enter or depart only at or about high water.

Political Geography of the Port

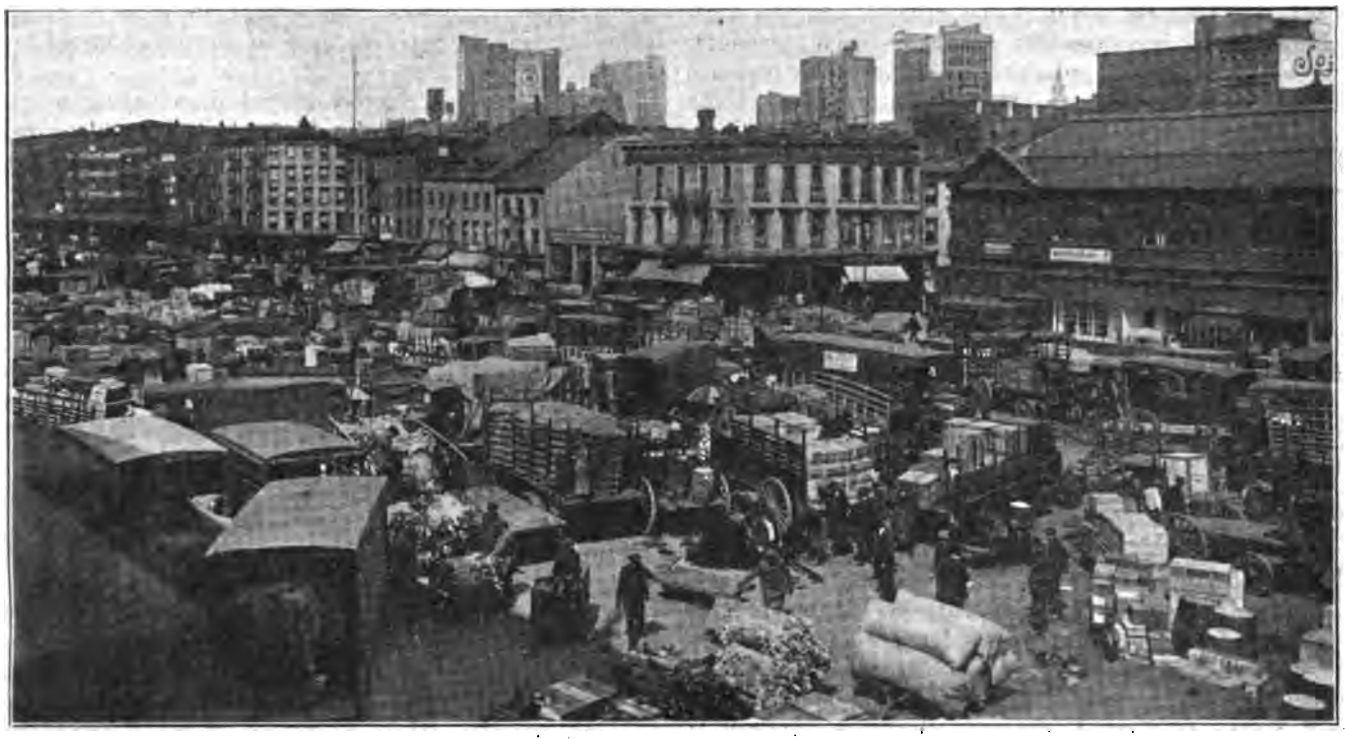
These physical characteristics of the Port District have inevitably had a large bearing on the political, commercial and industrial development of the Port. Manhattan, for example, nearly surrounded by deep water well sheltered from the open sea, and everywhere within easy reach of water craft in the days when such water craft afforded the only reliable means of transportation, was the inescapable first choice of the early settlers. And because it was the first choice, other parts of the present district, themselves also possessed of large natural advantages, have nevertheless been forced to take secondary positions. Jersey City, for example, received its first impetus as a terminus for railroads serving New York. On the other hand, the growth of the Port and the expansion of its activities have brought about increasing specialized demands, and some of these have been met by some of the younger communities of the Port, which have located at points physically adapted to the meeting of these demands.

Possibly the greatest deterrent to the harmonious development of the Port has been the state line separating New York and New Jersey. It is unnecessary to go into history here to explain why the large area comprising New York State should include the narrow appendage terminating in the island of Manhattan, and the offshooting Long Island, while another much smaller area running some distance up the west bank of the Hudson should constitute the State of New Jersey. Suffice it to say that these matters were settled by our colonial forefathers before it became apparent that this dividing line would be harmful to the best interests of those on both sides of it. The Commission believes the effect can be overcome by the execution of the comprehensive plan it recommends.

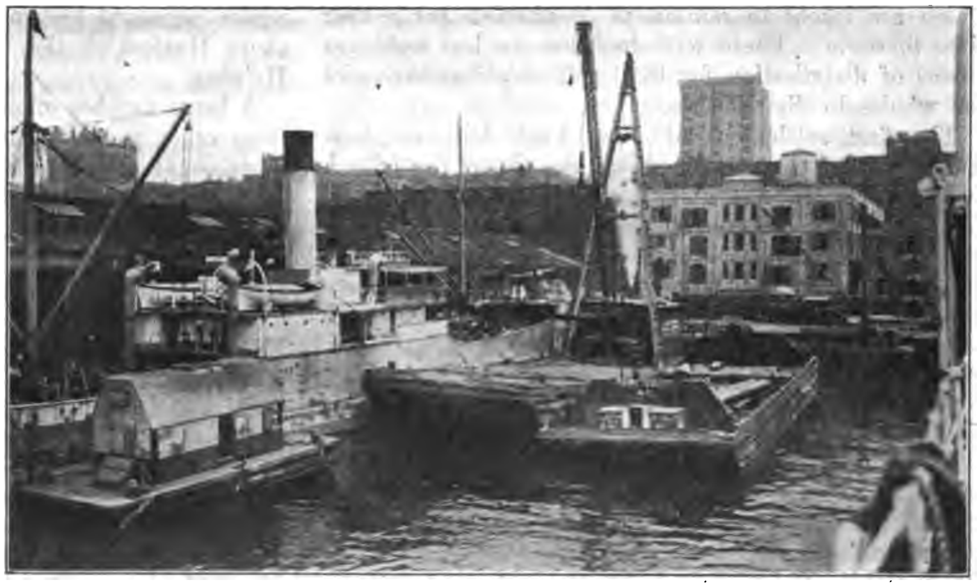
MANHATTAN

Of the subdivisions of these two major political divisions of the Port District, New York City is naturally thought of first, and New York City was originally confined to Manhattan. At the beginning of the nineteenth century it had a population of 60,000, at which time probably no other community of the Port could claim 10,000 inhabitants. The population of the present five boroughs totaled 79,216. The entire New Jersey population within the District was about 40,000.

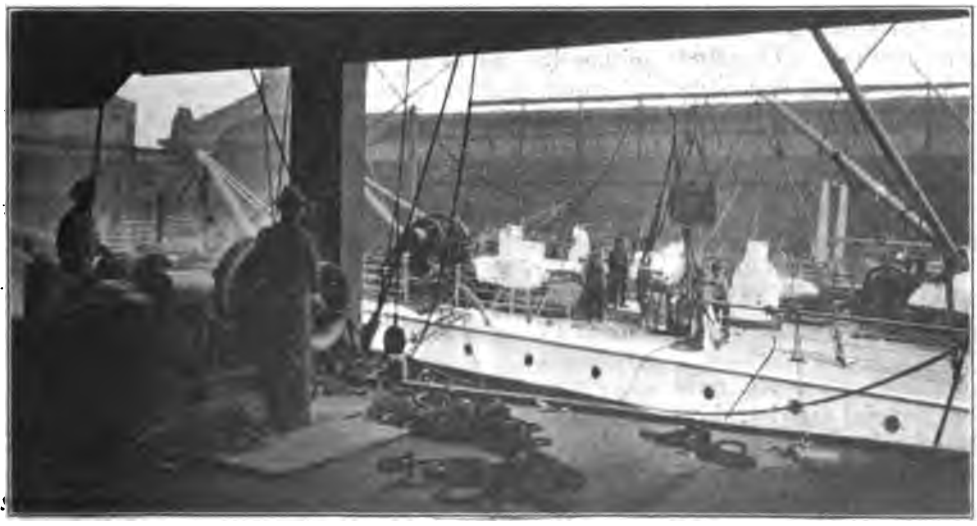
The city grew rapidly during the nineteenth century. Up to 1860 the growth per decade was usually more than fifty per cent. The Civil War had its natural



Street Congestion in Manhattan Incident to Distribution of Foodstuffs and Merchandise



A Brooklyn Steamship Terminal — Derrick Scow Handling Heavy Freight Between Ship and Lighter



Burtoning Operation Utilizing Portable Electric Winch on Second Floor of Pier effect in a slowing down of the growth, and the high percentage of increase was never resumed, although the actual number of inhabitants continued to increase rapidly. By 1900, just after the consolidation of the five boroughs to form the present Greater New York, the population of Manhattan was 1,850,093. A substantial increase was registered in 1910, when the figures show 2,331,542 inhabitants, but the 1920 returns of 2,284,103, showing a slight loss since 1910, suggest that Manhattan has nearly reached a state of saturation. (See table on page 80.) As almost all of the area of the island has been built upon and as the expansion of business has crowded out one residential district after another, it is not unlikely that in the course of time Manhattan will decrease materially in population.

It should be pointed out here that the census figures, which show the *resident* population, are no index of the *business* population. The industries that are slowly driving the dwellers out of lower Manhattan will continue to produce tonnage for the transportation systems, of a different character but greater in volume. The dwellers, removed to the Bronx, Westchester County, Long Island, Staten Island or New Jersey, will return to New York daily in large numbers to work raw materials into finished products, or to display and sell their goods in the great primary markets which are likely to remain in Manhattan for a long time to come. There will doubtless be less need for means of distribution for local consumption, but more for wholesale distribution.

The first settlement of New York City or New Amsterdam was concentrated at the tip of the island, and even in Revolutionary times there was little development two miles from that point. The march uptown was gradual. At the time of the Civil War it had hardly reached above Fifty-ninth Street. Before the formation of Greater New York in 1898 it had crossed the Harlem River, and part of the Bronx, which at the time of the consolidation had a scattered population of nearly 200,000, had been annexed to New York City.

The earliest census record of New York is for the year 1698. Its population at that time was 4,937. Boston was larger, with some 6,500 inhabitants. Then Philadelphia forged ahead, and at the close of the Revolution, while New York had passed Boston and was probably the largest city in the new-formed United States, Philadelphia and Boston, and Charlestown and Baltimore as well, were not far behind. The first Federal census, taken in 1790, places these five cities as follows: New York, 33,131; Philadelphia, 28,522 (42,444 including suburbs); Boston, 18,038; Charleston, 16,353; Baltimore, 13,503. Not until the opening of the Erie Canal did New York get the impetus that marked it for the metropolis of the land. (See Chapter 1, page 46.) Then, with the development of railroad and steamship lines, New York rapidly became the commercial and financial center of the continent.

Zones of Development—The most southerly mile of the island is given over to the financial district, shipping offices and a great variety of other business and professional offices. In this small area are a large percentage of the tall buildings which differentiate New York from every other city, and in it is a greater concentration of business than in any other equal area in the world.

Above this area is the central distributing market for the greater part of the Port District on the west (described more fully in Chapter 20 on markets and food distribution), a great wholesale and manufacturing district in the center and a residential district for factory workers on the east. This district at present occupies a belt about two miles wide, the north boundary being about Twenty-third Street. The district, however, is constantly expanding northward.

Next comes a belt the center of which is given over primarily to hotels, theatres and large retail department stores, flanked on both sides with residential property and a considerable number of industrial plants. This belt is nearly two miles wide. Like the wholesale district south of it, it has been moving northward, so that while fifteen years ago it hardly reached beyond Forty-second Street, it is now pushing above Fifty-ninth Street. In recent years, also, there has been considerable movement of offices into it from the downtown section.

Above this belt the island is mostly residential, with a large number of small retail stores to serve their immediate vicinity, and a considerable sprinkling on the east side of industrial establishments. The 125th Street region is known as Harlem. The high ground above Harlem on the West Side is called Washington Heights.

A large number of persons come to Manhattan daily from other parts of the Port to take part in the vast business of the island, not to mention a considerable number of transients there at all times for business or pleasure purposes. There are, however, so many permanent residents of the island in proportion to its area that nearly all live in apartment or tenement houses, some of which rise twelve stories or more. Even the separate houses of the well-to-do are mostly built on narrow lots of which they occupy the full width, and there are very few detached houses in Manhattan.

The greater part of the waterfront of Manhattan on both the Hudson and East Rivers below Fifty-ninth Street is owned by the city and used intensively though not in general efficiently for transportation purposes, by steamship companies or railroads. Above Fifty-ninth Street the development is intermittent.

Eleven railroads bring freight cars to the island, either by rail or by car float, exclusive of the Central Vermont Railway, which has a steamer service to and from its rail terminus at New London, Conn., and the Southern Pacific Company, which operates a steamship line to the Gulf ports. Six of the eleven railroads enter the island with their passenger trains, the others having ferry connections with passenger terminals in New Jersey.

Manhattan has the smallest area of the five boroughs, about 22 square miles.

BROOKLYN

Brooklyn, the second most populous borough of New York City, had only 5,740 inhabitants in 1800, grouped along the East River waterfront opposite the lower end of Manhattan. It grew rapidly, especially between 1830 and 1860, in each decade of which period its population more than doubled. By 1898, when it became a part of New York City, it had more than 1,000,000 inhabitants. In 1910 it had 1,634,351 inhabitants, while the 1920 census shows 2,018,356 inhabitants.

Situated on an island and reached only by water as recently as 1883, when the first Brooklyn Bridge was opened, Brooklyn had not the opportunity for independent development that New York (Manhattan) had. As New York grew Brooklyn became largely a residential center for those having business occupation in New York. Along its waterfront, however, there grew up a considerable number of industrial establishments, and a considerable part of its waterfront was also developed for the use of shipping. It was not and is not hampered in its territorial expansion as Manhattan was and is, and it has spread until now it extends to Newtown Creek on the north, Coney Island on the south and Jamaica Bay on the east. Important districts specially designated, originally separate settlements, are Williamsburgh and Greenpoint on the East River north of Wallabout Basin; Bay Ridge on the Upper Bay below Gowanus Bay; Flatbush, Bushwick and East New York in the interior, and Canarsie on Jamaica Bay.

Brooklyn has a land area of 70 square miles, and there is reason to believe that it will be the most populous borough in the city in a decade or two. It has much undeveloped area in the southern and eastern parts.

Several lines of the Long Island Railroad enter Brooklyn, and the majority of the other railroads of the Port have car-float terminals on the waterfront. There are also several short industrial railroads on the waterfront.

THE BRONX

The Bronx, which lies immediately north of the Harlem River and extends from the Hudson to the East River and Long Island Sound, with a land area of 42 square miles, had its origin in a number of villages, mainly on highways leading to New York, from which city they were at that time quite remote. Of these villages, the names of which are still locally applied, may be mentioned Mott Haven, High Bridge and Kings Bridge along the Harlem River; Port Morris just east of the mouth of the Harlem Kills; Morrisania, Tremont, Fordham and Williams Bridge in the interior along the Harlem division of the New York Central Railroad; West Farms near the head of tidewater on the Bronx River, Unionport and Westchester along Westchester Creek, and City Island in Long Island Sound.

It can be inferred that few of these villages had come into corporate existence in 1800, when the total population of the Bronx was 1,755. The population had reached only 8,032 in 1850, but in the following decade it jumped to 23,593, and thereafter the district expanded rapidly, more than doubling in population from 1890 to 1900 and again from 1900 to 1910. (See the table on page 80.) The 1920 population, 732,016, is again not far from double that of 1910.

The Bronx is mostly residential, with a considerable manufacturing development in the southern part along the Harlem and East Rivers, and scattered establishments elsewhere. There is a large amount of undeveloped waterfront on the East River beyond this industrial section, and on Long Island Sound, and there is also much undeveloped land in the interior of the borough. It is likely that the growth of the Bronx will continue as rapidly as at present for an indefinite period.

Three lines of the New York Central and the main freight line of the New York, New Haven & Hartford traverse the Bronx, reaching a large part of its waterfront. Other railroads have car-float terminals along the Harlem River. A small part of the New York Connecting Railroad is in the Bronx.

The communities of the Bronx were never brought together as a governmental unit prior to the formation of Greater New York, except that a large part of the area had been absorbed as part of New York City.

QUEENS

Queens grew into a borough of New York City in about the same manner as the Bronx. The main differences are that its area was much greater and its inhabitants were chiefly concentrated in a few communities widely separated. Even at present there are at least four rather distinct developed sections in the borough with much undeveloped land between them. It is conceivable that 100 years hence, if Queens is given the facilities for expansion, it will be the most populous borough of the Port.

Queens has an area of 105 square miles. It extends from the East River north of Newtown Creek to Jamaica Bay and Rockaway Beach, surrounding Brooklyn on two sides; and it reaches eastward on Long Island to Little Neck Bay on the north and Far Rockaway on the south, constituting a curved strip of land about sixteen miles long and ten or twelve miles wide.

In 1800 it had scattered through its wide area 6,642 inhabitants, or more than there were in Brooklyn. The growth of the communities producing this population was slow, however, so that Brooklyn showed the larger total in 1810, and in 1850 Queens still had only 18,593 inhabitants. The spurt shown in the other boroughs from 1850 to 1860 shows also in Queens, where the population almost doubled itself. From that time the growth has been rapid, but less so than in the Bronx, which overtook Queens in 1890. In 1900, just after the formation of Greater New York, Queens had 152,999 inhabitants, in 1910 it had 284,041, while the 1920 figures show 469,052.

At the time of the formation of Greater New York, Long Island City, which extended along the East River from Newtown Creek to the mouth of the Harlem, more than four miles, was the principal community of the borough. It had then probably 45,000 inhabitants, or nearly one-third of all the inhabitants of Queens. It was itself a consolidation of smaller communities, the chief of which were Hunters Point at the mouth of Newtown Creek, and Astoria at Hell Gate.

Flushing, at the head of Flushing Bay, was also a place of some size, with probably 10,000 inhabitants.

College Point, on the East River north of Flushing, had about 8,000; Jamaica, on about the central axis of the island and about eight miles inland from the East River, nearly as many. Other communities which still carry their early designations include Maspeth at the head of Newtown Creek; Woodside, Winfield, Elmhurst, Newtown and Corona, in the interior between Long Island City and Flushing; Whitestone, east of College Point on the East River; Bayside, on Little Neck Bay; and the group of summer colonies, Rockaway Park, Hammel, Edgemere, Arverne and Far Rockaway, along the south shore of Rockaway Beach.

Long Island City is largely industrial. The remaining occupied parts of Queens are chiefly residential. Throughout the borough, between the communities named and a few others are large areas on which there has been practically no urban development.

Several lines of the Long Island Railroad traverse Queens, as does the New York Connecting Railroad, owned jointly by the Pennsylvania and the New Haven. Otherwise Queens has no rail connection with the trunk lines of the Port.

RICHMOND (STATEN ISLAND)

Staten Island is the borough of Richmond. Its area is about 48 square miles. Its population was 116,531 in 1920. As yet its development has been almost wholly at the north end.

When Greater New York was formed, the village of New Brighton at the extreme northeastern tip of the island, nearest Manhattan, had upward of 20,000 inhabitants. Adjoining on the south, toward the Narrows, was a village nearly as large, the name of which, Edgewater, has disappeared in favor of the three earlier communities, Tompkinsville, Stapleton and Clifton, of which it was a consolidation. To the west of New Brighton, opposite Bergen Point, Bayonne, was Port Richmond, with perhaps 9,000 inhabitants. These three villages accounted for a considerable part of the population of the island, but there were numerous smaller villages, mostly unincorporated. For example, we find at the present time Livingston and West New Brighton along the north shore, between New Brighton and Port Richmond; New Dorp part way down the island on the Staten Island Rapid Transit Railroad; Linoleumville opposite New Dorp on the Arthur Kill; and Tottenville at the south end, opposite Perth Amboy.

In 1800 Richmond had 4,564 inhabitants, or nearly as many as Brooklyn or Queens; but they appear to have been well scattered. In time New Brighton and Edgewater took shape. Like Brooklyn, however, they were handicapped by being on an island, with only water access; while they were too far from Manhattan to offer the same residential inducements that Brooklyn could to those employed in New York. Consequently they and all of Staten Island fell behind in the procession. The growth of Richmond compared favorably with that of Queens and the Bronx up to 1870, but the rapid advance of those two boroughs in the last fifty years has not been matched by Richmond.

The island lacks adequate transportation facilities — connection with Manhattan and other parts of the Port, and lines to its own interior. It is admirably situated for the development of freight-steamship terminals with direct rail connection with New Jersey, and the program for twelve new piers now in course of construction by the City of New York, together with supporting warehouses over the marginal street and railroad facilities connecting with the piers and warehouses, should give it a new impetus. It has large areas ideal for commercial, industrial and residential development.

Its only railroads are the Baltimore & Ohio's freight line on the north side to St. George (New Brighton), and the local passenger line on the east side to Tottenville, owned by the same company but operated as the Staten Island Rapid Transit Railroad.

GREATER NEW YORK

Greater New York, the present city of New York, was formed in 1898 by the consolidation of the five previously described districts. Each of the five districts is a borough of the city. The governmental machinery of so large a city is necessarily complex, but it can be briefly outlined here. There are three principal governing bodies, the Board of Aldermen, the Board of Estimate and Apportionment and the Commissioners of the Sinking Fund. The Board of Aldermen is composed of sixty-seven members elected by the voters of individual wards, and a president elected by the voters of the entire city. The mayor, comptroller and president of the Board of Aldermen, elected by the voters of the city at large, and a borough president chosen from each of the five boroughs, constitute the Board of Estimate and Apportionment. The Sinking Fund Commission is made up of the mayor, comptroller, president of the Board of Aldermen, chairman of the Finance Committee of the Board of Aldermen, and the city chamberlain, who is appointed by the mayor.

A department of docks, headed by a commissioner of docks, has supervision over the waterfront development of all boroughs, subject in certain particulars to the approval of the Commissioners of the Sinking Fund. The bridges connecting the different boroughs, and the operation of the municipal ferries, are included within the jurisdiction of a single department of plant and structures. Other single departments with authority over the entire city include the departments of police, fire, health, welfare and parks.

A single department of finance has jurisdiction over the entire city. A transit construction commissioner and a public service commissioner, officials of the State government, have control over the construction and operation respectively of rapid-transit lines within the city.

Each of the five boroughs is also a county. Manhattan is New York County. Brooklyn is Kings County. The other three counties bear the same names as the boroughs. New York County formerly included the Bronx, but the latter borough was separated as Bronx County a few years ago. The county governments within the city are in the main subordinate to the borough and city governments.

The present New York City rivals London as the largest city of the world. The census figures of 1920 show a population of 5,620,048. The city's total land area is about 287 square miles, its water area bringing the figures up to about 320 square miles. From Tottenville to the north boundary line is thirty-five miles; to the east boundary line beyond Jamaica Bay, twenty-seven miles; from the latter point to the north boundary line at the Hudson River, twenty-four miles.

WESTCHESTER COUNTY

Contiguous with New York at the north boundary are three cities, Yonkers, Mount Vernon and New Rochelle, which, with the villages of Pelham, Pelham Manor and North Pelham, between Mount Vernon and New Rochelle, extend from the Hudson River to the Long Island Sound and have a combined population of about 185,000.

Yonkers — Yonkers lies along the Hudson for a distance of nearly five miles and extends eastward three miles, having an area of nearly 18 square miles. It had 2,968 inhabitants in 1840, 18,892 in 1880, 47,931 in 1900 and 100,176 the first of this year (1920). It has a number of large manufacturing establishments along the Hudson River waterfront and the Sawmill River; and a large percentage of its population is sustained by these plants. It is also the place of residence of a considerable number of persons who travel daily to business in New York.

The main line of the New York Central passes along the Hudson, while an industrial spur of the Putnam division serves the manufacturing establishments along the Sawmill River.

Mount Vernon and New Rochelle — Mount Vernon and New Rochelle are cities of comparable size, the former having 42,726 inhabitants according to the 1920 census, the latter 36,213 inhabitants, as compared with 30,919 and 28,867 respectively in 1910. Mount Vernon adjoins Yonkers on the east. It had a land area in 1916 of about 4½ square miles. New Rochelle is on Long Island Sound, its business center being about four miles from that of Mount Vernon. It occupies a greater area, which was 10 square miles in 1916. Both cities are mainly residential suburbs of New York.

Mount Vernon is on the New York Central (Harlem division) and the New Haven railroads, while New Rochelle is on the New Haven.

Pelham, Pelham Manor and North Pelham, residential villages, have a combined population according to the recent census of 5,196.

North of Yonkers along the Hudson and the main line of the New York Central are Hastings, Dobbs Ferry and Irvington, with respective populations of 5,526, 4,401 and 2,701; north of Mount Vernon on the Harlem line of the New York Central are Bronxville, Tuckahoe, Scarsdale and White Plains, with respective populations of 3,055, 3,509, 3,506 and 21,031; and beyond New Rochelle along Long Island Sound are Larchmont, Mamaroneck, Rye and Port Chester, with populations of 2,468, 6,571, 5,308 and 16,573 respectively. Of the foregoing Hastings and Port Chester have large industries. The others are mainly residential.

All of these communities north of New York City, including Yonkers, Mount Vernon and New Rochelle, are in Westchester County, which extends considerably farther to the north. The present population of Westchester County within the Port District is approximately 275,000 (see page 80).

The population of the few small communities in New York State west of the Hudson, in the vicinity of Piermont, is negligible, probably totalling less than 5,000.

The total population of the Port District within the State of New York is therefore approximately 5,900,000, according to the recent census.

NEWARK

Newark is the largest city in New Jersey as well as the largest New Jersey city in the Port District. Its present population according to the recent census is 414,216. It is also one of the oldest New Jersey cities. Newark occupies the west and south bank of the Passaic River from its mouth north and west about five miles in a straight line, but more than seven miles along the course of the river. It also extends southward about two and one-half miles along Newark Bay, and westward five miles from the bay. The present area is about 23 square miles, or slightly more than that of Manhattan.

The business center and oldest part of Newark are near the uppermost sharp turn in the Passaic River. From that point the city has expanded north along the river, west toward the Orange Mountains and south along the bay. The residential sections naturally grew away from the river to the north, west and southwest, while the lower lands, down the river toward the bay, were taken by industrial developments.

Newark is the home of a large number of persons traveling daily to New York, but it also has a large population employed in and dependent on Newark's industrial establishments, and a large self-contained business and office development. It utilizes the Passaic River for water commerce, but within the last decade has begun to reclaim the extensive undeveloped marsh land in the southern part of the city along Newark Bay and convert it into steamship terminal developments.

The city had a population of 6,507 in 1820. This had increased to 17,290 in 1840. In the next decade the increase was more than 100 per cent, and a steady and rapid increase has continued to the present time.

The main lines of the Pennsylvania, Lackawanna and Lehigh Valley railroads and branches of the Erie and the Central of New Jersey pass through the city.

JERSEY CITY

Jersey City is the second largest city in New Jersey. It had its beginning on the Hudson River waterfront opposite the lower end of Manhattan. It has expanded over all of the low land in front of Bergen Hill for a north-and-south distance of two miles, has gone over the hill to the Hackensack River and up the ridge more than a mile behind the city of Hoboken, and has reached nearly halfway down the Bayonne peninsula, to the city of Bayonne. The United States Census Bureau stated its land area to be about 13 square miles in 1916, while the 1920 census shows a population of 298,079.

In 1840 Jersey City had 3,072 inhabitants, as compared with 312,710 in Manhattan, 47,613 in Brooklyn and 10,965 in Richmond. The Pennsylvania Railroad had already obtained a foothold on perhaps the best Hudson River frontage within the present city limits, and within the next twenty-five years the Erie and the Central of New Jersey had obtained waterfront grants and the Pennsylvania had widened its frontage. Now the railroads occupy almost all of the Hudson River frontage and that on the Upper Bay.

During this period of railroad development, even though the development was for service to New York City rather than to Jersey City, the latter city grew by leaps and bounds, attaining 6,856 inhabitants by 1850, 29,226 by 1860 and 82,546 by 1870. Back of the railroad terminals on the low lands numerous and large industrial plants were established, while the high ground of the Bergen ridge was developed as a residential section.

After 1870 the percentage of increase per decade diminished, and the 1920 figure of 298,079 as compared with the 1910 figure of 267,779 suggests the inability of the city to expand much farther without such a reorganization of the Port as the Commission recommends, which will eliminate some of the railroad tracks which so largely monopolize the waterfront, or at least put them to the more direct service of Jersey City.

Except within the half-mile fringe of Hackensack meadow land within the limits of Jersey City, and land under water along the neck of the Bayonne peninsula, there is practically no undeveloped land in Jersey City.

Besides the three aforementioned railroads, the Lehigh Valley has freight terminals at the mouth of the Hudson, the Lehigh Valley and the West Shore have belt lines which connect and reach all of the other railroads, and the Lackawanna touches the northwestern part of the city, west of Bergen Hill.

PATERSON

Paterson, the third largest city in New Jersey, likewise comes within the Port District. It is situated on the Passaic River at the sharp turn around the Orange Mountains, about thirteen miles north of Newark. It is distinctly a manufacturing city. Located at the Passaic Falls in the Passaic River, it utilizes the water power and has a number of large industries, chiefly silk mills. Its inhabitants are largely employed in or dependent on the mills. A comparatively small number of workers in New York reside in Paterson.

The main line of the Erie, the New York, Susquehanna & Western and the main freight line of the Lackawanna pass through Paterson, and the Newark branch of the Erie terminates there. The Passaic River is not navigable to Paterson, although efforts have been put forth to have it made so.

The population of Paterson was 7,596 in 1840 and 19,586 in 1860. The city continued to grow rapidly from 1860 to 1890, but has slowed down considerably since then. Its 1920 population is 135,866 as compared with 125,600 in 1910. The city occupies an area of about eight square miles.

ELIZABETH

Elizabeth is the next largest city of the Port District. It is south of Newark, at the junction of Newark Bay and the Arthur Kill. It also lies along the Elizabeth River.

Elizabethport on the waterfront was of early importance as the first terminus of the Central Railroad of New Jersey and its tenant railroads. The business center is now about two miles from Elizabethport, at the intersection of the Central of New Jersey and Pennsylvania railroads.

Elizabeth contains important industrial establishments, and also residences both for those employed in those establishments and persons doing business in New York. Its population was 3,515 in 1820 and only 5,583 in 1850. Since then it has had a steady growth, reaching 73,409 inhabitants in 1910 and 95,682 in 1920. It has an area of nearly ten square miles within the city limits, this area including a considerable part of the undeveloped marsh land west of Newark Bay, with a frontage on the bay of more than two miles. The business centers of Newark and Elizabeth are about five miles apart, although the cities are contiguous.

Besides the main line of the Pennsylvania Railroad and the Central of New Jersey, the city is served by other lines of the latter in Elizabethport.

HOBOKEN

Hoboken lies immediately north of the Jersey City waterfront. It is entirely on the low ground in front of Bergen Hill, having a frontage of about one and one-half miles and a depth inland of three-fourths of a mile. Its development has been very similar to that of the lowlands of Jersey City. There is not the railroad occupancy of the railroad waterfront except in the southern part, where the Lackawanna has its terminals; but the remainder of the frontage, with the exception of Castle Point, is occupied by steamship terminals not in the control of the city. These terminals prior to the war were held by several of the German lines, but during the war they were taken over by the United States Government.

Hoboken had a population of 2,668 in 1850, 9,622 in 1860, doubled the latter figure in the following decade and continued to grow rapidly until 1900. In the next decade the increase was considerably less, and the 1920 figure of 68,166, as compared with the 1910 figure of 70,329, suggests an approach to saturation of the limited area of the city. This area is only 830 acres or less than 1½ square miles.

Within Hoboken are the main line and terminals of the Lackawanna Railroad, the belt line of the West Shore and the Weehawken branch of the Erie alongside, and the Hoboken Shore Road, an industrial line serving the steamship terminals.

BAYONNE

Bayonne, on the opposite side of Jersey City from Hoboken, occupies the remainder of the Bayonne peninsula, an area of somewhat more than four square miles.

Bayonne had only 3,834 inhabitants in 1870 and has shown a rapid growth ever since. Its population increased from 55,545 in 1910 to 76,754 in 1920. It is primarily an industrial city, its chief industries being the large oil works on Constable Hook. Despite the fact that it is almost completely surrounded by water, its waterfront has had hardly any development for shipping purposes.

The main line of the Central Railroad of New Jersey traverses the city, and a freight line of the Lehigh Valley runs to the end of Constable Hook.

PASSAIC

Passaic is on the west bank of the Passaic River, about four miles below Paterson. Like Paterson, it is primarily a manufacturing city and contains large industrial plants. The river is navigable for small craft up just beyond the northern boundary of the city, where the Dundee Water Power & Land Company maintains a dam.

Passaic has been one of the most rapidly growing communities in the Port District. It was incorporated in 1873 and had only 6,532 inhabitants in 1880. From that time its population was substantially doubled each decade until 1910, when it had 54,773 inhabitants. The 1920 census shows 63,824 inhabitants.

The city occupies about 3.2 square miles. The north boundary is about one and one-half miles from the south boundary of Paterson, while its south boundary is four miles from the north boundary of Newark. It is on the main line of the Erie and the main freight line of the Lackawanna.

PERTH AMBOY AND SOUTH AMBOY

Perth Amboy, which occupies the rounded point of land between the Arthur Kill and the Raritan River, at the head of the Raritan Bay, is one of the older of the New Jersey communities. It had 1,865 inhabitants in 1850. In 1880 it had only 4,808. Thereafter for each of the next three decades its population virtually doubled, reaching 32,121 in 1910. The 1920 figure of 41,707 shows a continuation of the steady growth. The city occupies an area of about 4.6 square miles, extending north along the Arthur Kill nearly three miles to the Woodbridge River, and west along the Raritan River about one and one-half miles.

South Amboy, across the Raritan River from Perth Amboy, had 4,330 inhabitants in 1890 and 7,897 in 1920. It has an area of about 1.5 square miles.

Perth Amboy is twenty miles by water from New York and Newark, distances which in the early days meant a much wider separation than at present. Its excellent location as a port has been pointed out, and it was originally quite independent of the communities on the Upper New York Bay and Newark Bay. One of the earliest railroads in the Port District, the Camden & Amboy, now a part of the Pennsylvania system, terminated at South Amboy across the Raritan River from Perth Amboy, and the Pennsylvania has always retained South Amboy as its principal coal terminus, while the Lehigh Valley in more recent years established its principal coal terminals in the northern part of Perth Amboy.

Perth Amboy and South Amboy have not continued to develop shipping to any great extent, other than that required by the coal terminals. They are mainly manufacturing cities, and the majority of the adult residents are employed locally.

NEW BRUNSWICK

New Brunswick is one of the oldest New Jersey cities within the Port District. It is located at the head of tidewater on the Raritan River, about nine miles west of Perth Amboy in a straight line, but nearly twelve miles following the river.

New Brunswick had 11,266 inhabitants in 1860. Its growth since then, until the last decade, has been slower than that of any of the New Jersey cities previously mentioned. In 1910 it had 23,388 inhabitants. The 1920 figures show 32,779 — a substantial gain. The city contains several large manufacturing establishments, and is also the home of a considerable number of persons employed in New York.

It is on the main line of the Pennsylvania Railroad and is the northern terminus of the Delaware & Raritan Canal, while a packet line operates down the Raritan River. The city extends several miles along the south bank of the Raritan River, including considerable farm land.

WEEHAWKEN, WEST NEW YORK AND VICINITY

North of Jersey City and Hoboken, on the Hudson River waterfront, Bergen Hill and the Hackensack Meadows as far as the Hackensack River, are seven towns which extend to the north and northwest boundaries of Hudson County. These towns are contiguous to each other and collectively have a population considerably in excess of 100,000.

Just north of Hoboken on the Hudson River waterfront is Weehawken. It extends one and one-half miles along the river and from three-eighths to five-eighths of a mile inland, barely reaching the top of the cliff except at the south end, where a large percentage of the inhabitants are to be found. On the waterfront at the north end are the terminals of the West Shore Railroad, at the south end one of the freight terminals of the Erie Railroad and between them the tract on which the Cunard line is about to build a large steamship terminal.

On the hill behind Weehawken and the north end of Hoboken are the town of West Hoboken, occupying about 550 acres, and the town of Union, more familiarly known as Union Hill, occupying about half that area. Beyond Union and Weehawken are West New York, which extends from the Hudson River to near the western side of the hill, with a waterfrontage of a mile and an area of about 620 acres, and Guttenberg, which occupies a strip of land about a quarter of a mile wide running from the Hudson a mile inland to the west brow of the hill.

Behind these towns on the Hackensack Meadows a strip of ground mostly marsh, four and one-half miles long and one and one-half miles wide, defined by the Hackensack River on the west and Penhorn Creek and Croma Kill on the east, constitutes the town of Secaucus. In this town are Snake Hill and the two or three lower hills rising out of the meadows, on which hills reside the inhabitants of the town. The eastern edge of the meadows north of the Jersey City line, the west slope of Bergen Hill and a strip of ground a mile wide running over the hill down to the Hudson, constitute the township of North Bergen. In it are New Durham, Granton, Bull's Ferry and other small communities.

The Weehawken yard of the West Shore Railroad extends into the waterfront of West New York, in which town are also the coal facilities of the New York, Ontario & Western. Beyond this point the cliff is close to the river and there has been little development, although the New Jersey Junction Railroad runs along the water's edge. In general the high lands of all of these towns are residential, the low lands on the Hudson side carry industrial establishments and railroad waterfront terminals, while the lands in the meadows are mainly waste, but contain various railroad yards and a few industrial plants. The main line of the Erie and Lackawanna and the passenger line of the Pennsylvania pass through Secaucus, the Secaucus yard of the Lackawanna being in that town. The West Shore Railroad, the Northern Railroad of New Jersey and the New York, Susquehanna & Western pass through the town of North Bergen, in which is located the New Durham yard of the West Shore.

According to the 1910 and 1920 Federal censuses, West Hoboken, the most populous of this group of communities, had 35,403 inhabitants ten years ago and 40,068 the first of this year. Union had respectively 21,023 and 20,651. Weehawken had 11,228 and 14,485. West New York, the most rapidly growing town of the group, had 5,267 in 1900, 13,560 in 1910 and 29,926 the first of this year. Guttenberg had 5,647 in 1910 and 6,726 the first of this year; North Bergen 15,662 and 23,344 respectively; Secaucus 4,740 and 5,423 respectively.

KEARNY, HARRISON AND EAST NEWARK

With the exception of a tract about a mile square in the bend of the Passaic River immediately opposite Newark, which constitutes the town of Harrison, and a much smaller tract along the river just north of Harrison, which is the town of East Newark, the tongue of land between the Hackensack and Passaic Rivers for a distance of about four miles from Newark Bay is all embraced in the town of Kearny. This covers an area of nearly nine square miles. All but a strip a mile wide along the Passaic River is marsh land, virtually undeveloped, although several large shipyards were established in the southern part during the war. The settled part of Kearny, which showed a population of 18,659 in 1910 and 26,724 the first of this year, is almost entirely along the east bank of the Passaic River north of Harrison and East Newark.

Harrison had a population of 14,498 in 1910 and 15,721 on January 1, 1920. East Newark had respectively 3,163 and 3,057 inhabitants.

All three towns are mainly industrial towns. The Pennsylvania, the Lackawanna and the Newark branch of the Erie pass through both Kearny and Harrison, while the Greenwood Lake branch passes through Kearny to the north of Harrison and the Newark branch of the Central Railroad of New Jersey crosses the extreme lower end of the marshy point between the Hackensack and Passaic Rivers.

HUDSON COUNTY

The cities and towns on the Hudson River waterfront and Upper Bay and on Bergen Hill from North Bergen to Bayonne inclusive, together with Secaucus, Kearny, Harrison and East Newark, constitute Hudson County. This county has about the same population as Essex County, in which is Newark. In the two counties are approximately 40 per cent of the inhabitants of New Jersey.

Hudson County was formed from other counties about 1840, when it had a population of 9,483. The census figures show that it had 386,048 inhabitants in 1900, 537,231 in 1910 and 629,154 the first of 1920.

EDGEWATER AND FORT LEE

Edgewater and Fort Lee, lying along the Hudson north of the town of North Bergen, virtually complete that part of the Hudson waterfront in New Jersey usable for port purposes. Beyond Fort Lee is the Interstate Palisades Park.

In Edgewater, which had 2,655 inhabitants in 1910 and 3,530 the first of 1920, are the Edgewater or Undercliff coal terminal of the New York, Susquehanna & Western Railroad, the western terminus of the Fort Lee Ferry and a number of important industrial plants on the lowlands along the Erie Terminals Railroad.

Fort Lee, which had 4,472 inhabitants in 1910 and 5,761 the first of 1920, is more residential. There are certain marine repair yards along its waterfront, which is susceptible to further use. At present it has no railroad facilities.

LITTLE FERRY, RIDGEFIELD PARK AND HACKENSACK

At the junction of Overpeck Creek and the Hackensack River is the borough of Little Ferry, and just north is the village of Ridgefield Park. Little Ferry had 2,541 inhabitants in 1910 and 2,715 the beginning of this year. The corresponding figures for Ridgefield Park are 4,512 and 8,570. The West Shore Railroad and the New York, Susquehanna & Western run through both places.

North of Ridgefield Park, on the west side of the Hackensack near the tidewater limit, is the town of Hackensack. It had 14,050 inhabitants in 1910 and 17,667 January 1, 1920. It extends along the river about three miles, having an area of four square miles. The New York, Susquehanna & Western and the New Jersey & New York railroads, both subsidiaries of the Erie, pass through it and the West Shore runs just east of it. It can be reached by small harbor craft. It is largely residential.

LYNDHURST, RUTHERFORD, GARFIELD AND LODI

Lyndhurst, Rutherford, Garfield and Lodi are the largest of a number of communities on the strip of substantial ground to the east of the Passaic River and north of Kearny.

Lyndhurst township is about midway between Kearny and Passaic. It is both industrial and residential, having 9,515 inhabitants the first of this year. It is on the main freight line of the Lackawanna.

Rutherford is just north of Lyndhurst, on the main line of the Erie and at the junction of the freight detour passing around Passaic and Paterson. It had

7,045 inhabitants in 1910 and 9,497 the first of this year. It is both industrial and residential.

Garfield is opposite Passaic, at the mouth of the Saddle River. It has important manufacturing plants and a 1920 population of 19,381, as compared with 10,213 in 1910 and 3,594 in 1900. It occupies an area about two square miles. It is on the freight detour of the Erie around Paterson, and is also reached by an industrial spur of the New York, Susquehanna & Western.

Lodi lies a mile northeast of Garfield on the Saddle River, two and one-half miles from Hackensack. It had 4,138 inhabitants in 1910 and 8,175 the first of this year. Its only railroad facility at present is a spur from the New York, Susquehanna & Western Railroad.

Belleville, Nutley and Clifton

Just north of Newark, on the west bank of the Passaic River, is the town of Belleville, with 9,891 inhabitants in 1910 and 15,660 the first of this year. Adjoining Belleville on the north is Nutley, which had 6,009 inhabitants in 1910 and 9,421 the first of this year. Both of these towns are mainly residential. Their only railroad is the Newark branch of the Erie.

Stretching over a considerable area, from Nutley to Paterson, and partly surrounding the city of Passaic, is what until 1917 was the township of Acquackanonk. This township had 5,351 inhabitants in 1900, 11,869 in 1910. In 1917 the township took the name, Clifton, of what had become a populous community just north of Passaic on the main line of the Erie. The enlarged Clifton showed 26,470 inhabitants in the 1920 census. It is traversed by the Lackawanna and the main line and Newark branch of the Erie.

Other Northern Communities — Bergen County

The territory north of Hudson County to the State line and west of the Hudson River to the Passaic as far as Paterson, as well as territory north of Paterson not included in the Port District, constitute Bergen County, which had a total population of 138,002 in 1910 and 210,688 the first of this year. There are no towns of any considerable size in this county outside of the Port District, and it is probable that 90 per cent of the inhabitants of the county live within the Port District.

There are numerous communities north of those mentioned. The most important of these are Englewood, four miles east of Hackensack on the Northern Railroad of New Jersey, which had 9,924 inhabitants in 1910 and 11,617 the first of this year; and Ridgewood, four miles north of Paterson on the main line of the Erie and near the north junction of the freight detour. Ridgewood had 5,416 inhabitants in 1910 and 7,540 according to the 1920 count.

Passaic County

West of Bergen County, also reaching to the New York State line, is Passaic County. Territorially only a small part of this county comes within the Port District as the Commission conceives it. That part, however, embraces Paterson, Passaic and Clifton, as well as the smaller towns of Hawthorne, Prospect Park, Haledon, Totowa and Little Falls north and west of Paterson, which collectively had about 13,000 inhabitants in 1910 and 17,000 the first of this year.

The county as a whole had 155,202 inhabitants in 1900, 215,902 in 1910 and 259,174 the first of 1920. The Commission estimates that the corresponding population within the Port District was 206,550 in 1910 and 246,941 the first of this year.

Irvington, the Oranges, Bloomfield and Montclair

The higher ground back of Newark, Belleville and Nutley, to the base of the Orange Mountains and in part well up the sides of these hills, has been highly developed, mainly for residential purposes. The territory referred to comprises eight cities and towns all contiguous to each other and containing a combined population of nearly 200,000 in an area of about 30 square miles.

Irvington, adjoining the southwestern part of Newark, had a population the first of this year of 25,480, as compared with 11,877 in 1910 and 5,255 in 1900. Irvington is more industrial than the places to the north of it, and is growing more rapidly. Its only railroad is a spur of the Lehigh Valley.

Just north of Irvington is a narrow extension of the city of Newark, formerly the borough of Vailsburg. North of that spur is East Orange; west of East Orange are Orange and West Orange; and south of Orange and West Orange, also adjoining Irvington on the west, is South Orange. East Orange and Orange, occupying the smallest areas of these four towns, are much the most populous, having 50,710 and 33,268 inhabitants respectively the first of this year as compared with 34,371 and 29,630 in 1910. Their land areas are respectively about 4 and 2.2 square miles. West Orange extends up and over the Orange Mountains with a land area of nearly 12 square miles, of which the population was 10,980 in 1910 and 15,573 the first of this year. The village of South Orange had a population of 6,014 in 1910 and 7,274 the first of this year. The township of South Orange, with 5,309 inhabitants according to the 1920 census, covers a much larger area over the mountains to the west.

The main passenger line of the Lackawanna passes through all of the Oranges except West Orange. A branch of the Erie passes through East Orange and Orange into the edge of West Orange. The large plant of the Edison Electric Company is located in West Orange.

North of the Oranges are Bloomfield and Montclair, each occupying a strip of ground more than four miles long and about one and one-half miles wide, the long dimension being approximately north and south Between them is the smaller town of Glen Ridge.

Bloomfield had 15,070 inhabitants in 1910 and 22,019 the first of 1920; Glen Ridge 3,260 and 4,620 respectively; Montclair 21,550 and 28,810. All three towns are on the Greenwood Lake branch of the Erie and the Montclair branch of the Lackawanna. There is considerable land in these towns not yet opened up for urban purposes.

ESSEX COUNTY

Newark, Irvington and South Orange on the south and Nutley, Bloomfield and Montclair on the north define the limits of Essex County, which includes these communities and extends from the Passaic River on the east to the same river on the west. Essex County and Hudson County, as previously stated, contain nearly half of the inhabitants of the State. Virtually all of the population of Essex County is in the cities and towns described. West of the main ridge of the Orange Mountains the territory is only sparsely settled. The only community of note is Caldwell, which had 2,236 inhabitants in 1910 and 3,993 the first of this year.

The total population of Essex County was 512,886 in 1910 and 652,089 the first of this year.

RAHWAY AND LINDEN TOWNSHIP

Rahway lies at the head of tidewater on the Rahway River, four miles west of the Arthur Kill and five miles southwest of Elizabeth. It is a manufacturing and residential city, with 7,935 inhabitants in 1900, 9,337 in 1910 and 11,042 the first of 1920. It occupies about four square miles.

Rahway is on the main line of the Pennsylvania Railroad and is the junction point for the Perth Amboy branch, and another branch to Roosevelt. Only the smallest of harbor craft can reach it by way of the Rahway River.

The township of Linden lies between Rahway and Elizabeth and embraces all of the north bank of the Rahway River and the west bank of the Arthur Kill. It is traversed by the main line of the Pennsylvania, the Long Branch line of the Central of New Jersey and the Chrome branch of the latter.

SUMMIT, WESTFIELD AND PLAINFIELD

Summit, Westfield and Plainfield are the largest of a number of residential communities inland from Elizabeth and Rahway. Summit is in the cleft in the Orange-Watchung Range caused by the Rahway River. It had 7,500 inhabitants in 1910 and 10,174 the first of 1920. It is on the main line of the Lackawanna Railroad.

Westfield and Plainfield are on the main line of the Central Railroad of New Jersey, at the base of the Watchung Range, seven and twelve miles respectively west of Elizabeth. Westfield had 6,420 inhabitants in 1910 and 9,026 the first of 1920. Plainfield had 20,550 inhabitants in 1910 and 27,700 according to the latest census. Contiguous with Plainfield on the north and west, but in another county not otherwise embraced in the Port District, is North Plainfield, which had 6,916 inhabitants the first of this year.

Between Elizabeth and Westfield on the Central Railroad of New Jersey are the smaller communities of Roselle, Roselle Park and Cranford. They have collectively perhaps 14,000 inhabitants.

UNION COUNTY

Lying just north of Essex County and embracing Elizabeth, Summit, Rahway and Plainfield, is Union County. Virtually all of this county can be considered within the Port District. It had 99,353 inhabitants in 1900, 140,197 in 1910 and 200,037 January 1, 1920.

The Port District as laid out extends a short distance into Morris and Somerset Counties to the west of Essex and Union Counties. North Plainfield, in Somerset County, contiguous with Plainfield, has about 7,000 inhabitants, as previously stated. Otherwise the population of these two counties within the Port District is negligible.

ROOSEVELT AND WOODBRIDGE

On the north bank of the Rahway River from Rahway west and also extending nearly three miles along the Arthur Kill is the borough of Roosevelt. This embraces the industrial communities of Carteret and Chrome.

Roosevelt had a population of 5,786 in 1910, which had increased to 11,047 the first of this year. It is traversed by the Long Branch and Chrome lines of the Central Railroad of New Jersey and by a spur of the Pennsylvania from Rahway.

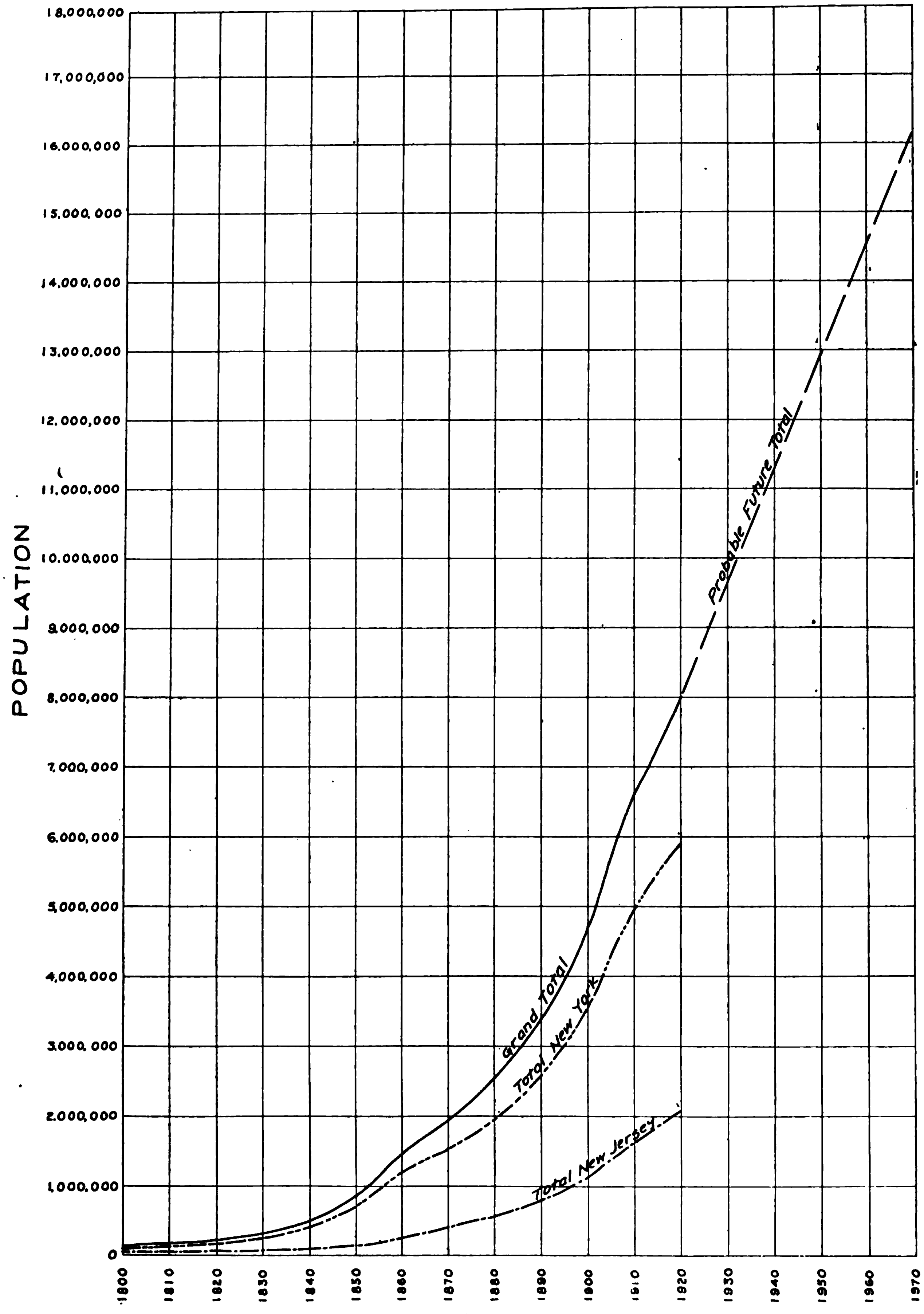
Filling the two-mile gap between Roosevelt and Perth Amboy along the Arthur Kill, and also extending around Perth Amboy to a frontage of more than two miles on the Raritan River, is the extensive township of Woodbridge. This township includes the Port Reading coal terminal of the Philadelphia & Reading Railway, the entire tidal section of the Woodbridge River, and numerous sand and clay plants back from the Raritan River, from which several short railroad spurs lead to the river.

Woodbridge had a population of 8,948 in 1910 and 13,423 January 1, 1920. It is traversed by the Long Branch line of the Central Railroad of New Jersey and the Perth Amboy branches of the Pennsylvania and the Lehigh Valley, as well as by the numerous industrial lines mentioned serving the clay industry.

RARITAN, METUCHEN, EAST BRUNSWICK, SOUTH RIVER AND SAYREVILLE

The township of Raritan (Middlesex County) occupies the north bank of the Raritan River between Woodbridge and New Brunswick, while East Brunswick and Sayreville occupy the south bank, Sayreville extending along Raritan Bay to Cheesequake Creek. In the interior of the township of Raritan is the borough of Metuchen, where the Perth Amboy line of the Lehigh Valley crosses the main line of the Pennsylvania. Between East Brunswick and Sayreville, about two miles up the South River, near the head of navigation by sand scows, is the borough of South River. The settlement known as Sayreville is in the northwestern part of the township of that name, on the Raritan River near the mouth of the South River.

Sand and clay are produced in large quantities in



Curves of Population of Port District From 1800 to 1920—Total Projected to 1970 this section, as in the Woodbridge district, and are loaded on scows of shallow draft. This constitutes the principal industry of the section. During the war explosives were manufactured in large quantities in the eastern part of Sayreville, in the vicinity of South Amboy.

Metuchen had 2,138 inhabitants in 1910 and 3,394 the first of 1920. South River had 4,772 in 1910 and 6,596 the first of 1920. For the townships at large of Raritan, East Brunswick and Sayreville the corresponding figures were 2,707 and 5,419, 1,602 and 1,857, and 5,783 and 7,181.

The territory north of the Raritan is traversed by the Pennsylvania and the Lehigh Valley railroads and by short spurs to the clay pits; that south of the river by the Pennsylvania and the Central Railroad of New Jersey, and by the Raritan River Railroad, a short independent line from South Amboy to New Brunswick.

MIDDLESEX COUNTY

Perth Amboy, New Brunswick, Roosevelt and the remaining territory along the Arthur Kill and the Raritan River, together with one or two townships farther inland, reaching to Bound Brook, the junction of the Philadelphia & Reading Railway and the Central Railroad of New Jersey, constitute as much of Middlesex County as is deemed within the Port District. The county extends more than halfway across the State. The total population of the county was 79,762 in 1900, 114,426 in 1910 and 162,334 the first of this year. Nearly 90 per cent of this population is estimated as within the Port District.

MONMOUTH COUNTY

The only remaining part of the Port District is the margin of Monmouth County along the Lower New York Bay and Sandy Hook Bay. The principal communities are Keyport at the mouth of Matawan Creek, Matawan two miles up it, Keansburg four miles east of Keyport, and Atlantic Highlands, six miles farther to the east, or three miles from Sandy Hook. There has been little commercial or waterfront development of this section, and the total permanent population hardly exceeds 12,000. There is a considerable summer population.

SUMMARY OF POPULATION OF PORT DISTRICT

The population and growth of the Port is summarized by counties in the accompanying table. The table includes on the New Jersey side the entire population to Hudson, Essex and Union Counties, slightly less than the total population of Bergen, Passaic and Middlesex Counties, and only a small percentage of that of Monmouth; on the New York side all of the population of the five counties of New York City, and a large part of that of Westchester County.

POPULATION OF PORT DISTRICT BY COUNTIES AND STATES

County	1900	1910	1920
New York (Manhattan)	1,850,093	2,331,542	2,284,103
Kings (Brooklyn)	1,166,582	1,634,351	2,018,356
Bronx	200,507	430,980	732,016
Queens	152,999	284,041	469,042
Richmond (Staten Island)	67,021	85,969	116,531
Total New York City	3,437,202	4,766,883	5,620,048
Westchester*	126,796	212,427	274,612
Total New York State	3,563,998	4,979,310	5,894,660
Hudson	386,048	537,231	629,154
Bergen *	65,242	120,268	190,890
Passaic *	147,854	206,550	246,941
Essex	359,053	512,886	652,089
Union	99,353	140,197	200,037
Middlesex *	70,070	102,866	147,458
Monmouth *	9,141	9,900	12,790
Total New Jersey...	1,136,761	1,629,898	2,079,359
Total Port District	4,700,759	6,609,208	7,974,019

* Part of county.

The estimated present population of the entire Port District is therefore 7,974,605, as compared with 6,609,208 in 1910 and 4,700,759 in 1900.

CHAPTER 3

Waterfront Control and Policy

Fundamental to the control and shaping of the development of the Port is the control of the waterfront itself. Nearly 800 miles of navigable waterfront are involved, 600 on the New York side and 200 on the New Jersey side. It is now generally conceded that public control of the waterfront is necessary for the best interest of the Port. This was not realized in the early days, when there was apparently a superabundance of waterfront for all purposes. In fact it is only in recent years that definite policies of public control have been in effect in the various municipalities on the two sides of the Hudson River, and these policies have grown out of a series of measures aimed in the right direction but not wholly adequate. Meanwhile the making of private grants has proceeded from the earliest days, in some sections of the Port more than in others, so that a considerable part of the most valuable waterfront is now in private hands, with or without restrictions as to the use of that waterfront. One of the problems of the port authorities now is to recover such waterfront.

In this respect New York is better situated than New Jersey, especially Jersey City and the other communities along the Hudson River waterfront. This is due to the fact that New York City early became a powerful unit, and the need for measures to safeguard its water-borne commerce against monopoly by a few private interests became apparent, while on the opposite New Jersey shore railroad developments to serve New York preceded the development of the communities themselves and the consequent need for public waterfront facilities. A result is that when Jersey City came to realize the need for public control, the city, or the State prior to the formation of the city, had yielded all of its waterfront except space for one wharf, while Hoboken had yielded its entire waterfront. These are the extreme cases. Throughout the Port, however, private interests hold much waterfront that the public will need to recover if the development of the Port as a whole is to proceed in a rational manner. Of approximately 578 miles of waterfront in New York City, for example, only 127 miles is publicly owned.

Given the desired public control of the waterfront, there remains the problem of assigning its use. It has long been stipulated that waterfront required for commercial purposes shall not be used for other purposes. The interpretation of what is required for commercial purposes has frequently changed with the development of the art, and will doubtless change in the future.

Assuming that waterfront needed for moving commerce will not be used for factories, amusement places or the like, there still remains the necessity for making it attractive to private transportation companies. This means that large companies, able to spend a considerable amount of money in terminal plants to facilitate their operations, must be insured by long-term leases against eviction and the consequent scrapping of such plants; while the smaller companies, unable to invest much of anything in terminal facilities, need accommodations at low cost, unhampered by long-term obligations. A well-ordered port for the various kinds of business found at New York will have all grades of facilities between these two extremes. Obstacles to such a stable and rational policy as is above outlined have been the control of the situation by local administrations frequently changing, and the division of jurisdiction between the duly constituted port authorities and other branches of the local governments interested as much in all other civic activities as in the administration of the Port. A permanent port authority separated from politics will encourage private interests to plan more aggressively for the future.

New York's Waterfront

In New York as elsewhere the original title of the land was vested with the crown, and when the colonies obtained their independence the title of such lands as the crown had not ceded to either the city or private interests went to the State. In the colonial days the crown began the cession to the city of the land required by it, including the waterfront. At first, when the sailing vessels were small and of shallow draft, it was apparently supposed that the city required nothing beyond low water. Later this was found insufficient for the needs of commerce, and a strip 400 ft. wide just outside of low water was turned over to the city. Subsequently this also was found inadequate and the strip was widened, while the necessity for fixing more definite limits resulted in the establishing of bulkhead and pierhead lines. In short, the changing demands of commerce have been met by a series of measures governing the control of the lands under water, and our colonial forefathers could by no means have foreseen the need for giving the city control of a belt under water at some points more than 1,000 ft. wide.

While the Dutch had control of Manhattan, in the first half of the seventeenth century, the title to the land rested with the Dutch West India Company, which had bought the island from the Indians and had further received it by grant from the Dutch States General.

In 1664 the English came into possession of Manhattan and the surrounding country. The first general grant affecting the waterfront was the Dongan charter, under which Lieutenant-Governor Thomas Dongan of the colony transferred to the city in 1686 "all the waste, vacant, unpatented and unappropriated land within the city and island, extending and reaching to low water mark . . . not theretofore granted by former governors or other properly constituted authorities of said city to some respective person or persons."

In 1708 the jurisdiction of the city was extended over the Long Island waterfront from Wallabout Basin to Red Hook by the Cornbury charter, issued by Governor Cornbury, which granted to the City of New York "a ferry from Nassau or Long Island over the East River to the city on both sides of the said river, and also all the vacant and unappropriated grants from high to low water mark on said Nassau Island from a certain place, called the Wallabout, unto the Red Hook . . . with all appurtenances, rents, issues and all the estate, right, interest, benefits, advantages, claims, etc., of the crown in said ferry, vacant land and premises". A reservation allowed the Brooklyn inhabitants to transport their own persons, goods and the like.

400-FOOT STRIP UNDER WATER

The Montgomery charter, granted in 1730 through Governor John Montgomery, confirmed the Dongan and Cornbury grants, gave the city the right to build wharves and piers and make ordinances regulating them, and established the beginning of the 400-ft. strip just outside of low water. The charter established one strip from about King Street on the Hudson River to Battery Place, and one on the East River from Whitehall Street to Corlears Hook.

These strips were extended northward in 1807 to about Seventy-fifth Street on the Hudson River and about Fortieth Street on the East River, by grants from the Commissioners of the State Land Office. In 1821 the Legislature granted the city the land under water at the Battery outshore to an irregular line considerably beyond the present sea wall. In 1826 the Legislature extended the 400-ft. strip up the Hudson and East Rivers to Spuyten Duyvil Creek and the Harlem River, and in 1852 the lands under these waters were granted to the city, completing the 400-ft. strip around Manhattan.

When the Department of Docks was created, in 1870, the Legislature authorized the Commissioners of the Land Office to convey to the city all property, right, title and interest of the people of the State of New York in and to the land under water required by the Board of Docks for the construction of wharves, docks, piers, bulkheads, basins and slips, whenever the commissioners might be required by the Board to make such conveyance. This in effect widened the 400-ft. strip to a maximum of about 1,000 feet.

In 1888 a strip of land under water was conveyed to the city along as much of the Bronx waterfront as was then within the city limits; namely, from the present city line on the Hudson River to the mouth of the Bronx River. In Brooklyn there has been no further conveyance to the city of the land under water than that provided in a general way by the Cornbury charter. In Queens the city holds title to the common and marsh lands in, under and about Jamaica Bay through a grant to the former town of Jamaica. In Staten Island the city has received a narrow strip covering the width of a few extended streets. The original charter of the greater city of New York grants in fee to the city the right, title and interest of the State in and to the land under water within the projected line of any street intersecting the shore line, whether for streets in public use or those hereafter to be opened for public use.

Although the city thus acquired control of the waterfront in accordance with or in advance of its supposed needs, it did not in the early days, because of financial obstacles, do much in the way of developing the waterfront. Such development as materialized was made by private interests who obtained grants from the city. Until 1844 these grants were made by the Common Council. Thereafter they were made by the Commissioners of the Sinking Fund.

WATERFRONT GRANTS

The first recorded grant was in 1686, to Peter Delancey. The grant was situated between Broad and Moore Streets. Like the others under the Dongan charter, it covered the land between high and low water.

Grants under the Montgomery charter usually extended across the 400-ft. strip. The original shore lines were in most places several hundred feet inshore from those of the present day, and in many instances successive grants have been made beyond the original ones. On the lower East River there have been three tiers of grants.

Subsequent to 1770 the grants contained provisions for the carrying of streets to the waterfront, and on the grantee was usually imposed the burden of building at his own expense a wharf at the foot of the street, the city to have half title to the wharf. Usually the grantee was also obligated to pave the street and keep it in repair forever. Legislation about 1888 relieved the property abutting on such streets from liability for the maintenance of the street.

When the State Land Board was created in 1766 it was authorized to grant land under water "to promote the commerce of the State". Up to 1832 it apparetnly did not interpret the quoted phrase as making any restrictions on the use of the property, and it placed no such restrictions. It then began to stipulate that the grantee should erect docks and wharves and fill in the land so granted within a specified period. In 1839, following legislation revising its authority, the Land Board adopted a new form of water grant which merely conveyed the right to erect docks and collect dockage, but did not cover title to the land. In 1850, after further legislation, the practice of granting the land was resumed, a land office being authorized to cede such land as it deemed necessary "to promote the commerce of the state, or proper for the purpose of beneficial enjoyment of the same by the adjacent owner".

From 1892 to 1900 a form of grant was issued which gave a "full beneficial enjoyment" conveying the fee without any conditions. In 1900 there was a return to the custom of making grants only for purposes of commerce or for restricted beneficial enjoyment.

DEVELOPMENT OF WATERFRONT BY PRIVATE INTERESTS

Through the successive forms of grants it is estimated that the city had at one time ceded to private interests more than 90 per cent of the waterfront below Forty-second Street, and in the last fifty years it has been put to great expense in recapturing this waterfront by agreement or condemnation proceedings and in either event at greatly increased values. The resumption of control is still incomplete.

Yet without the activities of the private interests it is doubtful whether the Port would ever have assumed the supremacy in competition with Boston, Philadelphia and other ports of equal or nearly equal importance in the Revolutionary days. The city had neither a policy for the development of the waterfront commercially, a departmental agency to carry out a policy nor the financial ability to carry it out. The private interests came forward and compensated the city in a measure, at least, for its grants, and on the whole, while the city did not exercise as much supervision over the use to which the waterfront was put as present knowledge of the demands of commerce would dictate, commerce was afforded an opportunity to develop, and did develop by leaps and bounds.

MARGINAL STREET

The Montgomery charter authorized the construction of a 40-ft. street along the waterfront, and grants made by the city under that charter usually provided for the building of this street beyond the 400-ft. line. The shore lines were irregular, and to straighten them out the Common Council in 1796 established West and South Streets 70 ft. wide each, at the same time extending the water lots theretofore granted out to the new streets.

Thus early the importance of continuous public access to the waterfront was recognized. In later years the need for something more than an ordinary street came to be felt, and the Marginal Way was established. This, so far as it has been opened up, is immediately outside of the marginal street itself without physical separation. West Street and the Marginal Way have a combined width of 250 ft. A considerable part of this width is at present occupied by bulkhead sheds, awning sheds and the like, and of late years there has been serious consideration as to whether the great width of the thoroughfare even without these obstructions does not make for congestion. The Commission believes it does and elsewhere proposes the use of a large part of it for warehouses, replacing the encroachment at ground level with upper-level driveways. This warehouse construction on the Marginal Way was made possible by the enactment of Chapter 809 of the Laws of New York, 1920.

DIVIDED JURISDICTION OVER WATERFRONT

Until the close of the eighteenth century, when West and South Streets were located, the question of the city's right to build piers outside the 400-ft. strip does not seem to have been raised. The opening of these streets brought that question to the fore, and in 1796 the Legislature authorized the city to build such piers as it desired.

The beginning of the nineteenth century marked the beginning of definite steps to develop and control the waterfront — steps which, however, resulted in a hopeless division of authority. In those days, as now, the undeveloped waterfront was marshy, and one of the most important considerations was land access to it. It is not strange, therefore, that the Common Council, which had in 1813 been authorized by the Legislature to construct and regulate wharves, delegated to the street commissioner's department the maintenance of wharves and the land and water access thereto — the authority involving street repairs and dredging. Waterfront work came under one of several bureaus of the Street Department, under a superintendent of wharves.

Harbor masters appointed by the Governor were created by the Legislature in 1819 to station and regulate vessels at wharves. Dock masters appointed by the city were established by the Common Council in 1838 to collect wharfage. The Sinking Fund Commission, organized by ordinance in 1844 and composed of the Mayor, Comptroller and other city officials, was authorized to take charge of the issuing of land grants, and of permits to build or fill in subject to the approval of the Common Council; while the same ordinance directed the Comptroller to take charge of the city's real estate and collect its rents.

Thus there were six agencies involved in the control of the waterfront — the Common Council and the Street Department to share the building of new facilities, the latter department to maintain them, the Sinking Fund Commission to make grants and leases, the Comptroller to collect rents, the dock masters to collect wharfage and the State harbor masters to regulate the movements of ships at the piers.

DEPARTMENT OF DOCKS CREATED

The year 1870 marks the beginning of a definite attempt to administer the waterfront in a manner befitting its importance through the creation of the Department of Docks. Section 99 of Chapter 137 of the Laws of the State of New York, which reorganized the government of New York City, established a board of five commissioners for five-year terms. The commissioners were to be appointed by the Mayor, and their powers, duties and compensation were to be fixed by the Commissioners of the Sinking Fund. The board was authorized to spend not more than $350,000 per year in the repair and reconstruction of wharves, piers and slips.

Chapter 335 of the Laws of 1873 reduced the Board from five to three commissioners, and gave it exclusive charge and control, subject in certain particulars to the approval of the Commissioners of the Sinking Fund, of all wharf property belonging to the city or subsequently to be acquired by the city. The department had power to control the construction, alteration and maintenance of wharves, and the dredging of channels around them; to regulate wharf property not owned by the city; to acquire property by purchase or condemnation proceedings, and to lease it for terms not exceeding ten years, with privileges of renewal for ten-year terms at increased rentals. Bond issues for the use of the department were not to exceed $3,000,000 per year and were subject to the authorization of the Commissioners of the Sinking Fund, which department also had charge of the sale of ferry franchises and the leasing of ferries. The Department of Docks was entirely independent of the Board of Estimate and Apportionment.

When the five boroughs were consolidated in 1898 to form the greater city the Department of Docks was redesignated the Department of Docks and Ferries, and received more extended powers.

In 1902, in accordance with Chapter 466 of the Laws of 1901, the dock board was replaced by a single commissioner appointed by the Mayor. This organization has since remained in effect, except that last year the ferries were by an act of the Legislature, introduced at the request of the Dock Commissioner, taken from the jurisdiction of the department and placed under the Department of Plant and Structures, and the department was redesignated the Department of Docks.

POWER AND LIMITATIONS OF DEPARTMENT

In the fifty years of its existence the department has built up a strong organization which has done much for the development of the New York side of the Port. It has been hampered, however, by the fact that its authority is divided with that of other branches of the city government less closely in touch with waterfront matters, that its revenues go into the city treasury and are not available for needed waterfront development, and that its head is subject to removal by the Mayor and usually has been removed with each change of administration. Naturally, also, its viewpoint is that of the City of New York and not necessarily the larger viewpoint of the entire Port of New York.

The Commissioner of Docks is empowered, without review by any other authority, to grant permits for the occupancy of wharf property for a period not exceeding one year; to designate wharves or sections of waterfront for various municipal uses and for the use of certain classes of individuals supplying the city with food or other products; to make contracts involving any sum less than $1,000; to regulate wharfage and dockage rates; to make rules to expedite the discharging, loading and clearing of vessels from wharves; to issue permits for all waterfront construction on private property, and to compel private owners to maintain sufficient waterway alongside their wharf structures and keep same in repair. Subject to the approval of the Commissioners of the Sinking Fund, the Commissioner may widen, open, construct, abandon or close exterior streets, and regulate the use of them; purchase wharf property in the name of the city after agreement with the owners as to purchase price, or request the Board of Estimate and Apportionment to direct the corporation counsel to institute legal proceedings to acquire such property by condemnation in case of nonagreement; and lease wharf property for ten-year terms, either by public auction or otherwise, subject to renewal at advanced rentals in ten-year terms aggregating not more than fifty years by public auction or otherwise. Subject to the approval of the Board of Estimate and Apportionment he may prepare and execute plans for terminal facilities and the equipment thereof.

FINANCES

Finances of the Dock Department are handled through the general city government, and the requirements of the department are considered together with the requirements of other departments. Red tape hampers the financial operations, and the recommendations of the Department as to the needs of the Port are subject to the approval of the budget committee of the city government. Maintenance of waterfront facilities may be paid for from taxes only; new improvements must be paid for through the sale of bonds. The income of the department, meanwhile, which consists ot pier rentals and wharfage collections, goes into the sinking fund for the redemption of the city debt. The borrowing power of the city is fixed by law, but bonds invested in self-sustaining waterfront improvements are exemptable from consideration in this particular.

ORGANIZATION OF DEPARTMENT

Besides the Commissioner of Docks, the department now has two deputy commissioners and four bureaus, as follows:

1. Administrative and Statistical Bureau.
2. Engineering Bureau.
    - a. Division of Design and Contract Supervision.
    - b. Division of Maintenance and Repairs.
    - c. Division of Maps and Surveys.
    - d. Division of Mechanical Appliances.
    - e. Division of Aeronautical Facilities.
3. Bureau of Superintendence.
4. Bureau of Accounts.

GENERAL PLAN OF WATERFRONT IMPROVEMENT

When the Dock Department came into being it found a confusion of piers and bulkheads built without any concerted plan, some controlled by the city, some by private owners and some jointly under a variety of forms of permits. The department immediately undertook to develop a general plan which it has designated the "new plan," beginning with the most congested section of Manhattan south of Fifty-ninth Street. The small tidal range and the necessity for providing as much berthing space as possible per linear foot of shore line led inevitably to the pier and bulkhead system. A bulkhead line was established as the limiting boundary for solid fill which might interfere with the tidal flow, and the principle of the exterior street or marginal way which should extend to the bulkhead line and be in effect a continuous wharf was put into effect. A second line known as the pierhead line, several hundred feet outside of the bulkhead line to give sufficient length of piers for the longest ships to dock alongside them, was fixed, beyond which there must be no construction. Between the bulkhead line and the pierhead line the construction must be on piles to permit the free passage of water under them.

In 1888 the United States Government, through an act of Congress, assumed control of the fixing of bulkhead and pierhead lines. Since that time the Department of Docks, finding its early estimates of the maximum length of steamships inadequate, has applied from time to time to the War Department to move the pierhead line outward, and usually its applications have been successful.

The clear waterways in the Hudson and East Rivers have been greatly narrowed since the days of Hendrick Hudson, first by the filling in of the land to successive bulkhead lines hundreds of feet beyond the original shore line, and then by the several extensions of the pierhead line. Apparently the safe limit has been reached, and a recent application by the Department of Docks of the City of New York for a relocation outward of the pierhead line from Leroy Street to Seventy-second Street has been vigorously opposed by the New Jersey interests. The application was denied, although a rehearing was granted by the Secretary of War upon which there has not as yet been a decision. Recent application for extensions on the Hudson River from Battery Place to Pier 11 and on the East River from Pier 6 to Pier 17 were granted.

While the basic principle of piers, bulkheads and marginal streets is undoubtedly the correct one for those parts of the waterfront of the Port already developed and much of that not yet developed, the sizes and character of the piers and their uses are far from ideal. This is partly because private interests through permits obtained from the city had already committed large sections of the waterfront to uses not compatible with a broad general plan; partly because the demands of shipping were different fifty years ago from those of the present time, and the policy of narrow piers unsuited to modern machinery and lacking supporting warehouses was established, beyond revision except at great expense, while they were still adapted to the needs of the day; and partly because until 1898 only the shores of Manhattan and the Bronx and after that date only the waterfront east of the State line came within the scope of the department.

The Department of Docks has laid a good foundation for the broader development recommended by the Commission. Its usefulness will continue and grow in the working out of an intensive plan for the City of New York compatible with the general plan for the entire port.

OTHER NEW YORK COMMUNITIES

Public waterfront lands in New York State outside of New York City are under the control of the Commissioners of the Land Office, who have authority to dispose of them to municipalities or private interests through patents.

A combined bulkhead line and pierhead line has been established by the Federal Government in the Hudson River from the north line of New York City to a point north of the business district of Yonkers. The water along this line ranges from 28 to 38 ft. in depth, according to the Federal harbor line maps. No local or State control is exercised over any extension out to the bulkhead and pierhead line, except as to such of the land as still vests with the State. Under the terms of the establishment of the line in its present location it was specified that solid fill between it and the shore line "shall not be undertaken until a War Department permit has been obtained therefor . . . revocable and subject to the condition that any slips needed in the future must be constructed shoreward of the pierhead and bulkhead line either by excavating the filled area or otherwise."

New Jersey's Waterfront

The control of New Jersey's waterfront has been more uncertain and irrational than that of New York's, mainly because there was no central community to bring out the need of a definite policy. Control was delivered to various private interests before there was any realization of the value to the public of such control. Now the communities, particularly Jersey City and Hoboken, find themselves confronted with involved legal questions handicapping recovery of the waterfront they sorely need.

The titles to the New Jersey lands under water, like those to similar New York lands, rest primarily on the doctrine of the sovereignty of the king. In 1664, when the British took possession of New York and vicinity, much of the land along the coast from Maryland to Maine was granted by King Charles II to James, Duke of York, who in the same year sold to Berkeley and Carteret what is now New Jersey. New Jersey was in 1676 divided into East and West Jersey and held by what was known as the "lords proprietors". In 1702 the proprietors surrendered to Queen Anne, among other things, the title to the soil of the tidal waters. The title of the lands under water, being vested in the king, became vested in the people as a result of the Revolutionary War.

EARLY DISPUTES OVER TITLE TO WATERFRONT

In 1702 the proprietors surrendered to Queen Anne all the rights of government held by them, reserving, however, the rights of property. The title to the soil of the tidal waters was not within the reservation, and thereafter a dispute arose as to the ownership of these lands under water. After the Revolutionary War the State of New Jersey claimed that the title had reverted to the crown along with the rights of government, and that the result of the war made the lands the property of the State. The United States Supreme Court so decided in a test case. The proprietors never relinquished their claim, however, and made grants as late as 1880 — one in 1746 of Bedloe's Island to Arch Kennedy, one in 1803 on Harsimus Cove to Elisha Boudinot, one in 1835 of Black Tom, one in 1880 of the island on which Robbins Reef Lighthouse stands, and another in 1880 of Oyster Island to George H. Cook. The latter grantee applied to the State for a confirmatory grant, but it was refused. The State authorities do not recognize such claims.

In 1880 the State granted to the United States Government the right to the site of Robbins Reef lighthouse. This grant was accepted by the United States Government, the action being regarded as placing the stamp of confirmation upon the title of New Jersey to the lands under water as paramount to that of the proprietors. Further support of that view was given in 1901, when an application was made for certain land under water about midway between Ellis and Bedloe's Islands. The applicant subsequently sought the approval of the United States War Department of the lines defining the development. The Federal Government refused to establish the lines. The establishment of lines by the Government, however, would not have conveyed any title of ownership for the lands under water, but simply recognition of their use in the interests of commerce.

From about the beginning of the eighteenth century the Legislature had from time to time made grants

In 1802 a conditional grant of two years was made to Nathaniel Budd of part of the land embraced in the grants of the proprietors to Elisha Boudinot the following year. In 1804 the State of New Jersey by a special act incorporated the Associates of the Jersey Company. Under the terms of this charter practically all of the land under water in front of the southern part of old Jersey City has been reclaimed and certain piers have been constructed. In 1836 the State made a grant to Nathaniel Budd of 53½ acres lying on the Hudson River between Fourth and Twelfth Streets in Jersey City, virtually the same tract assumed to have been granted by the proprietors in 1803.

Numerous other special acts were assumed to grant riparian rights in the different waterways of the State. Among them might be recited that to the Hoboken Land Improvement Company in 1838, which pertained to virtually all of the lands under water at Hoboken; that to the Annetts in 1844, to the Hudson County Dry Dock and Wet Dock Company in 1845, Hudson River Steamboat Company the same year, Bloomer's Wharf in 1848, Bergen Point Ferry Company in 1849, Tillou's Ferry the same year, Annett's Ferry in 1854, Bergen Point and Staten Island Ferry Company in 1868, Englewood Dock and Turnpike Company in 1869, United New Jersey Railroad and Canal Companies of the same year.

The passing of such acts thus continued many years after the passage of the Wharf Act in 1851 — until the revision of the constitution in 1875 made them impossible. Some of them were merely incorporations, which probably carried no power of assignment of the corporate powers, although property actually owned by the corporation could presumably be sold. The distinction between most of the legislative grants and that to the United New Jersey Railroad and Canal Companies is that the United companies paid a substantial sum of money. The distinction between the special acts and the grants made by the Riparian Commission or its successors is recognized in Paragraph 4 of the general Riparian Act of 1869, which provides for the payment of $50 per front foot by the beneficiary of such legislative grant for a paper capable of being recorded, showing the riparian rights.

WHARF ACT

No particular supervision or control seems to have been exercised over the lands under water until 1851, when the Legislature passed the Wharf Act, authorizing the owners of lands upon tide waters to wharf out to navigable water. The Act outlined the necessary procedure to be followed in obtaining the right to build such wharves. If it was desired to build beyond ordinary low water, a license must be obtained from the Board of Chosen Freeholders of the county, the application must be advertised for six weeks and notice must be posted in conspicuous places, after which the freeholders might grant the license.

Among the provisions of the act were the following: That the license should be recorded in the county clerk's office; that the wharf should be built within five years of the issuance of the license; that the right of the same should be thereafter vested in the shore owner and not assignable except with the upland, and that it should pass with any sale of the upland as appurtenant thereto, thus clearly recognizing the inherent right of the shore owner to the use and advantage of the waterway. The act defined the term "shore" as the land between the limits of ordinary high and low water; the term "shore line" as the edge of the water at ordinary high water; and the term "shore owner" as the owner of the lands above and adjoining the shore line. No specific provision was made in the act as to compensation to the State.

RIPARIAN COMMISSION CREATED

In 1864 the Legislature appointed a commission "to ascertain the rights of the State and of the riparian owners in the lands lying under waters of the bay of New York and elsewhere in the State." Out of this investigation grew further legislation in 1869 making permanent the board, known as the Riparian Commission, repealing the Wharf Act as applied to the waters of New York harbor.

The freeholders acting under the Wharf Act had granted licenses freely. Through the creation of the Riparian Commission it was presumably thought that the public's interest in the waterfront would be better safeguarded. In its early years the new Commission was also liberal, and the legislation creating it was repeatedly amended to define the Commission's powers and duties more specifically. The Wharf Act was repealed in 1891 with respect to the remaining waters of the State. The Riparian Commission was reorganized in 1892 and again in 1894, being then designated the Board of Riparian Commissioners, and composed of the Governor and four other members appointed by him. After that it appears to have been somewhat more difficult for private individuals or companies to gain control of public lands without adequate compensation.

ATTITUDE OF STATE

The attitude of the State as it took shape through the legislation relating to the Board of Riparian Commissioners is that the State owns the lands under water unless it has conveyed the title to them outright. Through the Board it has offered the upland owner the option of acquiring or leasing these lands. If the upland owner refused to avail himself of this opportunity the lands could be sold to another applicant, but in few such instances has the upland owner failed to exercise his prior right.

As on the New York side, the Board received authority to establish pierhead and bulkhead lines before the Federal Government took any action in the matter; but the Federal Government, perceiving a danger in permitting independent authorities in two different States on the opposite sides of a river to reduce its width, established a board to control these lines in the interests of commerce and navigation. In general the policy of the Board and its successor bodies has been to establish its pierhead and bulkhead lines either coincident with or inshore of the Government lines.

All money received from the sale or rental of the State's land under water goes to the support of the free schools of the State.

CREATION OF ADDITIONAL BODIES

Within the last twenty years other bodies have been created to look after various phases of water-borne commercial activities, and all have been consolidated with the Board of Riparian Commissioners to form the Board of Commerce and Navigation. The latter Board has broader powers than any of its predecessors, but still has no authority to direct port development along a broad general plan or to rectify mistakes of the past.

In 1908 a law was passed to regulate the use of power vessels on the State's navigable waters, through inspectors appointed by the Governor. This law was purely a safety measure, and had nothing to do with commercial requirements.

In 1908 a Department of Inland Waterways, headed by a Commissioner, was created, with the duties of maintaining, regulating the use of and reporting annually on the inland waterways of the State, investigating the need for additional waterways and constructing those authorized. The department's chief activities were in conjunction with the construction of the so-called Inland Water Way connecting the bays and inlets of the New Jersey coast. A separate body, the New Jersey Ship Canal Commission, consisting of five non-salaried members, was created in 1911 to study the needs of that projected waterway.

In 1911 a resolution was passed by the Legislature authorizing the Governor to appoint a commission of three to co-operate with a similar body representing New York State and a seventh commissioner appointed by the President of the United States to investigate the needs of the Port. The New Jersey members made several reports, and on their recommendation the New Jersey Harbor Commission of five members was created, in 1914. Its functions were to investigate and report annually on waterfront conditions and needs, and to pass upon waterfront improvement plans contemplated by any individual, corporation or municipality. The same year the New Jersey Ship Canal Commission was consolidated with it. The Board of Riparian Commissioners retained its control over the waterfront.

BOARD OF COMMERCE AND NAVIGATION

The following year, 1915, the Board of Riparian Commissioners, the New Jersey Harbor Commission, the Department of Inland Waterways and the office of the power vessel inspector were consolidated into the Board of Commerce and Navigation, a body of eight non-salaried members, appointed by the Governor subject to the approval of the Senate.

The duties and powers of the Board combine those of the bodies it replaced. Through its control of the disposal of waterfront lands indisputably the property of the State and its veto power over plans for waterfront development it is able to prevent the launching of enterprises which it may consider inimical to the public welfare. It now seldom deeds waterfront lands to private interests, but grants sixty-year leases, fixing the rental at the beginning for a twenty-year period, and reserving the right thereafter to establish a new rate for each ten-year period. Its only means of recovering lands already ceded to private interests, however, is through proof of defective title, as it has no power of condemnation. It has no general port plan to use as a guide in approving or disapproving new projects, no authority or machinery for developing such plan, no means for getting it executed if developed.

Individual municipalities have the right to condemn lands needed by them for waterfront improvements, and to construct such improvements. It is obvious, however, that individual municipalities acting independently cannot solve the Port problem effectively, even on the one side of the Hudson River. There is no semblance of a unified plan such as continues in effect in New York City, even though modified in its details by successive administrations. There are almost no public wharves, almost no revenues derived from leases of publicly created facilities, such as contribute heavily to New York's treasury. Large areas of waterfront are dormant because the shallow waters have not been filled as on the New York side. Only through a single authority with broader powers than the Board of Commerce and Navigation enjoys can New Jersey hope to make full use of her magnificent natural advantages in the Port of New York.

CHAPTER 4

History of New York's Shipping

It is just four years short of four hundred years since the explorer Verazzano viewed New York harbor — the first known European visitor. It is upward of three hundred years since Hendrick Hudson, in 1609, made what may be termed the commercial discovery of the river bearing his name, which resulted in the settlement of Albany in 1624 and New York two years later. To tell the whole story of the development of New York's shipping in the three centuries since Hudson's time would require more space than this entire report occupies. In that period the primitive sailing shallop of perhaps the capacity of a modern freight car has grown to the large and fast sailing clipper of the nineteenth century, which has in turn been rendered well nigh obsolete by steam propulsion and the development of steel ships capable individually of taking the contents of several freight trains.

The growth and changes in the trade and in the methods and scale on which it is conducted has been no less pronounced than the changes in the ships themselves. In the early days one company had a monopoly of the trade. Now two hundred take part in it, of which scores handle more traffic individually into and out of the Port than the one company did. As late as the end of the Dutch occupancy of New Amsterdam a single pier was seemingly sufficient for the ocean-going commerce of the Port, the goods being transferred in small boats between that pier and the ships anchored in the stream. Now single companies require a number of piers to transact their business.

DISCOVERY OF NEW YORK HARBOR

Verazzano came to New York in 1524 and returned to Europe with a report of a very large river. Gomez came a year later and named the river after St. Anthony. From then until 1609 Dutch, French and Spanish traders are supposed to have made more or less use of the harbor and the Hudson, but it was left to Hendrick Hudson in the latter year to sail up the river and learn of its possibilities for developing the fur trade of the interior.

It is no accident that the Port of New York of today is at the mouth of a river navigable for 150 miles, as well as on an unsurpassed harbor. Water transportation, in the absence of either railroads or highways, was the only means of access to the interior. Evidence of the importance of this access is found in the fact that Albany was settled before New York was.

BEGINNING OF TRADE

Hendrick Hudson's report to Holland of the possibilities of the river which bears his name resulted immediately in the beginning of New York's commerce, the opening of fur trade between the Dutch and the Indians. The first vessel to engage in this trade came in 1610, the year after Hudson's discovery. In 1613 a ship was burned in New York harbor, and it was replaced by the first ship to be built here — a vessel said to have been 44½ ft. long of 16 tons capacity.

In 1614 the United Netherland Company received a charter to do business on the Hudson River. The company was limited to four voyages and a three-year period of operation. The first really effective opportunity to develop the fur trade came to the Dutch West India Company, which obtained in 1621 the exclusive privilege of trading in the province of New Netherlands for twenty years. It is common knowledge that Peter Minuit, representing the Dutch West India Company, bought Manhattan Island from the Indians in 1626 for about $24, and became its first Governor.

Trade grew rapidly despite the monopoly of the West India Company. Timber and fur were the first commodities handled. The earliest known manifest of a vessel clearing from the Port shows a cargo of 7,246 beaver skins and 1,000 skins of other animals, together with oak timber and hickory. This was in 1626. The value of the cargo was between $25,000 and $50,000.

The year 1627 marks the beginning of the domestic coastwise trade, the result of a visit to New England by the Dutch Governor. Relations between the Dutch and English colonists were not cordial at first, but by 1635 there was a considerable exchange of commodities. The coastwise trade was of course considerably quickened when the English took over New Netherlands.

Shipbuilding at the Port was retarded in its infancy when Minuit brought about the construction of the *New Netherland,* a vessel of a tonnage variously reported between 600 and 800 tons. She proved too large for the traffic, Minuit was recalled for his extravagance and few if any more ships were built in New York for some time.

BREAKING OF MONOPOLY AND EXPANSION OF TRADE

The West India Company's monopoly was broken in 1636, and there was immediate opening of trade and increase of colonization. The vessels of private merchants entered the field.

The trade was still hampered by the prevalence of piracy and privateering, by heavy duties so long as the Dutch remained in control, until 1664, and by a period of depression during the first years of the British occupation of New York, while England was still at war with Holland. Despite all the discouragements the traffic continued to grow, although it was far below that of New England, Virginia or Carolina. When peace was restored between England and Holland the English government took steps to foster trade; but even then maritime wars and the depredations of pirates continued to interfere with the orderly growth of commerce. The operations of the pirates were not, however, altogether to the disadvantage of New York, inasmuch as New York was for some time a haven for the pirates, to the great profit of many New York merchants.

Another factor in the growth of the Port was the passage in 1678 of the Bolting Act, which gave the city a monopoly among the cities of the New World in the bolting and packing of flour for export. The importance of this monopoly in the flour business is shown, states Thomas A. Janvier in his historical sketches, "In Old New York," in the fact that in 1694 more than 600 of the 983 buildings in the city depended in one way or another on the trade in flour.

The city at this time had less than 5,000 inhabitants, and was confined almost entirely to the area south of Wall Street. It was growing rapidly, as the following figures, taken from Janvier, attest:

Year	Number of houses	Number of beef cattle slaughtered	Annual revenues	Sailing craft hailing from port		
				Ships	Boats	Sloop
1678	384	400	£ 2000	3	7	5
1694	983	Nearly 4,000	5000	60	40	28

EIGHTEENTH CENTURY DEVELOPMENT

The city continued to grow steadily in population and commerce. It is recorded that 211 vessels entered and 220 cleared from the Port between December 1, 1729, and December 5, 1730.

The values in English pounds of the goods moved between Great Britain and the colonies during the eighteenth century up to the Revolutionary War for the colony of New York as well as for New England, Virginia and Maryland, and Carolina, are presented in the accompanying table, the figures being taken from 1897 report of the State Engineer and Surveyor of the State of New York. The figures cover only the individual years.

VALUE OF TRADE BETWEEN GREAT BRITAIN AND THE AMERICAN COLONIES AT TEN-YEAR INTERVALS

Year	Virginia and Maryland	New England	Carolina	New York
	Exports			
1697	£ 227,756	£ 26,282	£ 12,374	£ 10,093
1707	207,625	38,796	23,311	14,283
1717	296,884	58,898	41,275	24,534
1727	421,588	75,052	96,055	31,617
1737	492,246	63,347	137,758	16,833
1747	492,619	41,771	107,500	14,992
1757	418,881	27,556	130,889	19,168
1767	437,936	128,207	395,027	61,422
1774	612,030	112,248	432,302	80,008
	Imports			
1697	£ 58,796	£ 68,468	£ 5,289	£ 4'579
1707	237,901	120,631	10,492	29,855
1717	215,962	132,001	25,058	44,140
1727	192,965	187,277	23,254	67,452
1737	211,301	223,923	58,986	125,833
1747	200,088	210,640	95,529	137,984
1757	426,687	363,404	213,949	353,311
1767	437,628	406,081	244,093	417,957
1774	528,738	562,476	378,116	437,937

During most of the colonial period there were a few powerful shipping companies, but many private ship owners operating one or two ships each.

STAGNATION AND RECOVERY AFTER THE REVOLUTION

The Revolutionary War brought New York's advance to a standstill, and even the triumph of the colonies did not relieve her of the threat of decay and ruin. During the war the city had twice been swept by fire. Immediately following the war the liberated colonies were mostly shut out from the European and British West Indies trade through the lack of an established government and commercial treaties with other countries. The effect on New York is depicted by Janvier as follows:

> "When New York was evacuated by the British troops, November 25, 1783, the condition of the city was miserable to the last degree. Streets which had been opened and graded before the war began had been suffered to lapse again to idle waste; the wharves, to which for so long a while no ships had come, had crumbled through neglect; public and private buildings, taken possession of by the military and used as barracks, as hospitals and as prisons, had fallen into semi-ruin; along all the western side of the town was the wreck left by the fire. In this dismal period the population had dwindled from upwards of 20,000 to less than 10,000 souls; the revenues of the city, long uncollected, had shrunk almost to the vanishing point; the machinery of the government had been practically destroyed. In a word, without the consoling glory of having suffered in honorable battle, the city was left a wreck by the war."

American resilience proved equal to the test placed upon it. Steps were immediately taken to build up trade with the Orient. The Napoleonic wars engaging the attention and resources of the European countries were favorable to this, and the United States went rapidly to the forefront. The change for the better in New York's condition, as Janvier describes it, makes more pleasing reading:

> "The brilliant growth with which New York revived from what seemed to be its dying condition affords a striking proof of its inherent strength and vitality. Within three years from the date of the evacuation the former population had been regained, and within five years more a further increase of 10,000 had made the total 30,000 souls. Commerce, likewise, had returned to and then passed its former highest limit. Public and private enterprise once more had been fully aroused. In every way the energetic life and the material prosperity of the city had been more than regained.
>
> "Before the Revolution, the filling in of the East River front had been carried forward as far as Front Street. Immediately upon the revival of commerce this work was taken in hand again — the more readily because the increasing size of ships called for deeper water at the wharves — and South Street was begun. At the same time, new streets were laid out to the east and west of the Bowery; even Broadway, at last, began to show more signs of becoming an important thoroughfare; the streets leading out of Broadway to the North River were graded, and some of them were paved — but this region, then and for a long while afterward, was the worst quarter of town. What tended, however, most of all to give the city an air of fully restored vitality was the erection of new buildings on the sites so long covered by the desolate wreckage of the two fires."

The merchant fleet of the United States is stated to have increased from 201,562 tons in 1789 to 747,965 tons in 1795 and to 1,280,167 tons in 1820, half of the fleet being in the foreign trade. Ninety per cent of our trade was at that time, it is estimated, handled by American vessels. And the growth of our merchant fleet continued until in 1860 we had a greater tonnage than the United Kingdom and nearly as much as the entire British Empire.

STEAM VERSUS SAILS

The first steamship to cross the Atlantic was the *Savannah*, built by Francis Fickett in 1818 at New York City. She is described in Morrison's "History of American Steam Navigation," published in 1903, as being 100 ft. long, of 28-ft. beam and 14-ft. depth, carrying the same spars and sails as a sailing ship. After making two or three coastwise trips Morrison states that she left Savannah for Liverpool, May 24, 1818, reaching the latter port June 20. Her machinery and fuel supply occupied so much space that little was left for cargo, in consequence of which she was converted into a sailing vessel. Within four years she was totally wrecked.

In the last half century or longer the United States has been second to no country in the development of inventions. Strangely enough, however, our failure to hold our own with our European rivals in the merchant-marine service is attributable in large measure to our failure to realize the possibilities of an invention at New York's very door — the little steamboat *Clermont* in which Robert Fulton sailed up the Hudson in 1807. For some seventeen years, until the United States Supreme Court in 1824 dissolved the monopoly of Fulton and Livingston, others who might have used steam propulsion were discouraged from doing so by the claim of Fulton and his associates of the exclusive right to this form of propulsion. Meanwhile the developing of sailing vessels to meet the rapidly increasing trade was being pushed, and even after the Supreme Court opened the way to the use of steam by all, and the British shipbuilders began to apply steam to transatlantic ships, American shipbuilders thought they could outdo the British with large and fast sailing vessels.

For a generation or more they were successful. The clippers, as the ships were called, were built larger and larger, the monarch of them all, the *Great Republic*, built in 1853, being 325 ft. long, of 53-ft. beam and 4,565 tons capacity. She was square-rigged, and according to a photograph of her, carried more than twenty sails. The Commission has no record of her fastest performance across the Atlantic, but one of her smaller sisters made the trip in nine days and seventeen hours. The British were at first having indifferent success with steam. Side wheels were used exclusively, and were relied upon merely as an aid to the sails, being set so high that they were entirely clear of the water when the ship was without load.

In the course of time, however, iron hulls replaced wood, screw propellers took the place of the old paddle wheels (the first transatlantic screw propeller being put into service about 1850) and steam demonstrated beyond question its superiority over sails. Between 1850 and 1860 the proportion of ocean freight carried by steam is said to have increased from 14 per cent to 28 per cent; and the era of the clipper was past. In extenuation of our wasted efforts on an obsolete method of navigation, it may be noted that the vast resources of the United States in coal and iron were still largely unknown, and American shipbuilders believed England had all the advantage with respect to both products. When we learned we could not compete with sailing vessels and that we could build and operate steamships Britain had obtained a supremacy that we have never overcome.

Early Steamship Companies — The Cunard Line

None of the companies in the transatlantic trade in the colonial days are in existence at present. The companies operating the clippers of the first half of the nineteenth century have likewise disappeared. The first transatlantic steamship line, the Great Western Steamship Company, was short-lived. The second, which sent out its first steamship in 1849, was the Cunard Company.

Samuel Cunard, the founder of the company, was an American of Welsh descent, born at Halifax in 1788. He entered the shipping business, and as early as 1838 was negotiating for the establishment of a line between Liverpool, Halifax and Boston. The Great Western Steamship Company was ahead of him with a proposition to carry the mails between England and America, but Cunard underbid the other company and received a ten-year contract. Four wooden paddle boats, each of 619 tons, were built, and the first of these, the *Britannia,* made the voyage from Liverpool to Boston in the summer of 1840 in fourteen days and eight hours, including twelve hours at Halifax.

The first contract called for twenty round trips per year, but by 1845 the increasing demands of trade were met by a new contract for a weekly line. Under this second contract half of the boats were run to New York. Four larger and faster wooden vessels were built.

In 1849 a competitor, the Collins line, subsidized by the United States Government, entered the field with larger ships. The keen competition led the Cunard Company in 1855 to build its first iron ship, the *Persia,* which was for some time faster than any other vessel afloat. Like the other steamships of that time, she was rigged for auxiliary sail power and had side paddle wheels. She made a maximum speed of 16½ knots and an average speed of 14 knots, and was of 3,300 tons gross.

In 1858 the Collins Company went out of business. The Cunard Company continued to improve its service, building the *Scotia* in 1862, the largest, fastest and last of the side wheelers. New York became the sole port for all of the mail service, although smaller and slower vessels were run to Boston. It is noteworthy that these inferior vessels were screw-propelled, but the same year the *Scotia* was launched, the Cunard Company built the *China*, an iron screw of 2,539 tons gross, which demonstrated the superiority of screws over paddle wheels, on the grounds of both greater speed and economy in space.

The founder of the company died in 1865. The company continued to play its part in the development of steamships and is today active in all parts of the world. It is most commonly thought of by the public as one of several lines operating fast passenger liners with frequent sailings to and from Europe. But it is a heavy freight carrier as well.

International Mercantile Marine Company

The *China* was not the first successful transatlantic screw propeller. In 1850 the Inman Line, founded by William Inman of Leicester, England, began business between Liverpool and Philadelphia with the iron screw *City of Glasgow*. In 1857 the line was transferred to New York, where it became so popular that by 1866 the service was increased to semi-weekly sailings.

Many new vessels were built to take care of the ever-growing trade, and in 1888–89 the company put into operation two ships, the *City of New York* and the *City of Paris*, each with twin screws and each of about 10,500 tons gross. A great advantage of the twin screws was the ability to proceed with a rudder out of commission.

The company was reincorporated as the International Navigation Company in 1893, and in 1902 the amalgamation of the line with the White Star, Red Star, American, Atlantic Transport, Leyland and White Star-Dominion lines resulted in the formation of the International Mercantile Marine Company. Like the Cunard Company, it has high-speed passenger service to and from Europe and other parts of the world, and freight service as well.

Steamship Moored at Manhattan's Most Modern Pier

OTHER EUROPEAN LINES

The Hamburg-American Line is one of the oldest of the transatlantic lines, having been organized as the Hamburg-American Packet Company in 1847. At first it relied upon sailing vessels, but in 1853 it put into operation an iron screw of 2,349 tons. Its business grew so that by 1872 it was giving a weekly service. It built four twin-screw vessels in 1888, the same time the Inman Line built the *City of New York* and the *City of Paris,* and up to the beginning of the war in 1914 it was one of the active competitors for the transatlantic business.

Another German company, the North German Lloyd, was organized in 1857. It likewise grew rapidly and was one of the largest factors in the transatlantic trade as well as that of many other parts of the world at the beginning of the war. The Compagnie Generale Transatlantique (French Line) was formed in 1862, and has remained the principal line to and from France. The Holland-America Line was organized in 1872, to ply between Netherlands and the United States, as its name implies. The Red Star Line was organized about the same time, to run between the United States and Belgium. Its first service was between Philadelphia and Antwerp, but another line was installed to and from New York, and this became the principal route. Subsequently the Red Star Line became part of the International Mercantile Marine system.

Other companies were formed to specialize in passenger and freight service between New York and Spain, Italy and the Scandinavian countries, and still other lines, listed in Chapter 7, have grown up to take part in the vast freight traffic across the Atlantic. Several of these latter lines are possibly more important to the business of the Port of New York than some of those specifically mentioned in the preceding paragraphs. The passenger lines, however, driven by keen competition to provide the maximum speed, safety and comfort, have probably done most to develop the many improvements that have been made in steamships since the *Savannah* crossed the Atlantic in 1818. Besides the substitution of iron hulls for wood and of screw propellers for paddle wheels, these improvements include the development of twin screws, compound, double and triple expansion engines, steam turbines, water-tight compartments, wireless apparatus and countless other inventions that have changed shipping from the precarious and time-consuming adventure of Hendrick Hudson's day to a safe enterprise and one that can be conducted with rapidity and regularity. The few 800-ft. and 900-ft. ocean greyhounds in existence are far less important to the Port of New York than the many 400-ft. and 500-ft. freighters; but the freighters are better ships because of the competition that has resulted in the greyhounds.

AMERICAN TRANSATLANTIC LINES

Up to the recent war, which played havoc with the world's shipping and resulted among other things in the unprecedented shipbuilding activities of the United States Shipping Board, the United States left the developing of transatlantic steamship lines almost entirely to European interests. There are two principal exceptions to this statement — one the Collins Line, which as already stated furnished the Cunard Company keen competition in its early years, the other the American Line.

The American Line was established in 1871 by the Pennsylvania Railroad Company to operate between Philadelphia and Liverpool. The line was under the control of the Pennsylvania for some thirteen years, after which it passed into the hands of the International Navigation Company, predecessors of the International Mercantile Marine Company.

OTHER FOREIGN TRADE

Aside from the European trade, which of course began with the first settlement in the American colonies, the West Indies trade was the earliest foreign trade of the colonies, and it was of great importance before the Revolutionary War. As most of the islands were under British control the Revolution cut off our commerce with them, and we have seen that our merchants immediately began to repair their losses by building up the China and other Far Eastern trade. Subsequently came the trade with South America, Africa and other parts of the world.

Two of the pioneers in steamship service to China, and probably the two oldest participants now in existence, were the Pacific Mail Steamship Company and the Panama Railroad. The steamship company, chartered in 1848, sent its first vessel out for San Francisco, via Panama, the same year. The Panama Railroad Company, incorporated the following year, opened a line across the Isthmus of Panama in 1855. Its purpose was to effect the transfer of through cargo between ships on the Atlantic and others on the Pacific. It was authorized, however, to operate steamships on both oceans, and it did this to such an extent that there was sharp competition between the two companies on both oceans. The competition continued until 1895, when the Pacific Mail Steamship Company withdrew from the Atlantic and the Panama Railroad Company from the Pacific. The former company had inaugurated steamship service between San Francisco and China and Japan in 1867.

Regular steamship service between New York and Havana was inaugurated in 1859. The Civil War interrupted this service, but after the war a number of companies sprang up, the Atlantic Mail Steamship Company in 1865, Alexander & Sons in 1869 and the Clyde Line about the same time. James E. Ward & Company, founder of the Ward Line, operated sailing vessels until 1877.

Steam operation to and from Brazil dates from 1866, when the New York & Brazil Mail Steamship Company opened its line. The company had a mail contract for ten years with the United States Government and made monthly trips. It first enlarged its fleet rapidly, but went out of business in 1875. For two or three years there was no service to Brazil, and even though a second company was organized in 1878 it was some years later before the service reached a sound basis.

The Red "D" Line, after operating sailing vessels in the Venezuelan trade for about forty years, installed steamships in 1879. This company has remained in operation in the same trade ever since.

In all of the foreign trade there has grown up beside the large steamship companies with regular sailings for particular ports small companies maintaining only a few vessels in the "tramp" service — that is, vessels dispatched whenever and wherever cargo is available. This is entirely natural. New York trades with all the world, but the volume of that traffic is large enough and constant enough only to and from the chief ports to warrant a regular service. The large lines seem to have all they can do to handle this regular business, and there is much freight left for the tramps and small independent vessels. In the case of certain commodities, such as grain, the tramp steamer plays a larger and more important part than the liners.

COASTWISE SHIPPING

Coastwise shipping had its beginning in 1627, when Peter Minuit made his voyage to New England to establish friendly commercial relations. In the absence of either railroads or good highways the colonies depended almost entirely upon the coastal waters for intercommunication, and there grew up an extensive exchange of commodities.

In 1809, two years after Fulton steamed up the Hudson with the *Clermont,* the steamer *Phoenix* went from New York around Cape May to the Delaware River for service in that river. A little later other vessels built in the north sailed down the coast for service in Southern waters, but it was a number of years before any regular coastal service was instituted. The steam sloop *Albermarle* made a few voyages in 1818 between New York and Wilmington, N. C. The *Robert Fulton,* built in 1819 for ocean service, in 1820 began service between New York and Cuba via Charleston and New Orleans. This vessel, which was 158 ft. long, of 33-ft. beam and 10-ft. draft, proved to be a success as a sea-going steamer, but the business was not sufficient to pay, and the line was abandoned in 1825.

Regular coastwise service may be said to date from 1832, when a small steam packet, the *David Brown,* began to operate between New York and Charleston. Larger vessels replaced her later. Before 1840 Charles Morgan had the beginning of the Morgan Line in operation, with service from New York to several Texas and Mexican ports, as well as local service in the Gulf of Mexico. Service to Norfolk, disregarding an unsuccessful attempt in 1822 and another in 1835, dates from 1844, when Peck, Clyde & Company, with a screw-propelled vessel 160 ft. long, effected the beginning of the Clyde Line. The New York & Savannah Steamship Company began operations between those two points in 1848. Steamship service between New York and New Orleans, including the carrying of mails, had been established the preceding year, the ships touching at Charleston, Savannah, Havana and Chagres. The stops at Charleston and Savannah were discontinued after two years.

Other companies came into being to serve one or more of these ports, and there were numerous rate wars. Some of the original companies were put out of business, others survived and grew prosperous, while still others in present existence are considerably younger than the pioneers. One of these latter is the Mallory Line, which dates from 1871.

PRESENT ORGANIZATION OF COASTWISE SHIPPING

At the present time there is a fairly definite assignment of territory between a few companies. The Old Dominion Line had the Norfolk trade for many years, maintaining daily sailings, although it abandoned this a few months ago. The Ocean Steamship Company has the Savannah trade. The Clyde Line touches Jacksonville, Charleston and Wilmington, but not Norfolk or Savannah; it also has a line to San Domingo. The Mallory Line confines itself to Gulf ports — Galveston, Mobile, Tampa and Key West. The Southern Pacific Steamship Company (Morgan Line) is a competitor of the Mallory Line in the Gulf territory, touching both New Orleans and Galveston. The Clyde and Mallory lines, as well as the Porto Rico and Ward lines, which serve Mexico and the West Indies, have become amalgamated as the Atlantic, Gulf & West Indies Steamship Lines.

The vessels of these lines conform to a distinctive type of steamship design. In general they differ from the transoceanic vessels in that while they have the high sides necessary to make them seaworthy in heavy seas, they have side ports as well as hatches, and much of their cargo is trucked through the side ports. Most of them operate on a close schedule, and they are built for rapid loading and discharging rather than for large cargoes. They average smaller than the vessels in most of the transoceanic trades, but the difference is not marked. Some of them are oil burners, with a high percentage of cargo space and capable of high speed.

LONG ISLAND SOUND AND HUDSON RIVER SERVICE

Steamer service in Long Island Sound preceded railroad service along the parallel mainland. The New York & Rhode Island Steamboat Company installed a semi-weekly service between New York and Newport in 1822, the boats making a one-way trip in twenty-five hours, including a stop at New London. Faster boats in 1829 reduced the time from New York to Providence to sixteen hours. Other companies entered the field, some operating between New York and Providence, to connect with the newly opened Boston & Providence Railroad, others, after the completion of the Providence & Stonington Railroad, operating from New York to Stonington.

Because of these lines parallel railroads developed slowly. (See Chapter 5, History of New York's Railroad Development, page 105.) Ultimately the railroads were built and proved capable of taking a large traffic. Yet so great is the exchange of commodities between New York and the populous New England districts that the Sound lines have continued to draw a heavy traffic. There have been bitter rate wars and a number of the lines have been forced out of business. At the present time there are four principal companies, of which the New England Steamship Company, controlling the Fall River, Providence, New Bedford, New Haven and Bridgeport lines, is in turn controlled by the New York, New Haven & Hartford Railroad.

As the vessels in the Sound service run in sheltered waters most or all of the way, a type different from that in the south coastwise service has been developed — vessels with shallow hulls and the superstructures carried on top of the main decks. There are no hatches, loading and discharging are performed entirely through side ports, and in many of the vessels the upper decks are devoted exclusively to passenger service. Even more than in the case of the Southern coastwise service, the objective has been quick turnarounds rather than large cargoes.

Hudson River traffic has a history in a general way similar to that of the Sound. The development of the inland steamboat has reached probably its highest stage here, and we find on the longer runs between New York, Albany and Troy, vessels as large as the smaller ocean freighters; with far less cargo-carrying capacity, however, because they are devoted primarily to passenger service. Smaller vessels ply upon the shorter lines of the river, carrying much miscellaneous freight, while a large amount of coarse freight, such as building material, is towed in scows.

FERRIES

The ferries, at least the railroad ferries across the Hudson and the Manhattan-Staten Island ferries, are of great importance — scarcely less so than in the days when they provided the only means of communication between the different parts of the Port.

Ferry service between New York and Brooklyn and between New York and New Jersey was established in the seventeenth century. The first ferryboats were rowboats in the main, although sails were used to some extent. Travel on them was precarious, as the winds and the tides often carried them entirely out of their courses. Steam ferries were tried shortly after Robert Fulton's first steamboat appeared, but for a time they were hardly able to compete with the team ferries, propelled by horses, which were introduced about the same time.

Hudson River Service — The first Hudson River ferry was established in 1661 between New York and the foot of Communipaw Avenue, in the vicinity of what is now the passenger terminal of the Central Railroad of New Jersey in Jersey City. The rowboats constituting the fleet made trips Mondays, Wednesdays and Fridays "unless extraordinary occasions prevented". The proprietor amiably held that his charter prohibited persons from crossing the river in any other way, but it does not appear that he was able to enforce this claim.

About 1700 a ferry to Weehawken was established; in 1764, one to Jersey City, then called Paulus Hook; in 1775, one to Hoboken. In these early days it is stated that there were passenger barges about 20 ft. long and 7 ft. wide, rowed as a rule by four men and carrying about fourteen passengers; and baggage ferries, rowed by two men, and carrying horses and baggage.

In 1809, two years after Fulton had demonstrated the feasibility of his steamboats, he applied for the right to operate the Paulus Hook ferry. About the same time John Stevens, who owned the shore line of Hoboken, petitioned to establish a steam ferry to and from Hoboken. Both petitions were granted. Fulton and Stevens raced to see which could get his steam-ferry service in operation first, and Stevens was successful, putting into service in October, 1811, what was probably the first regular steam-ferry service in the world. Fulton inaugurated his ferries in July, 1812.

Fulton's earliest boats were described as of two parts, each 80 ft. long, 10 ft. wide and 5 ft. deep, separated by a strongly braced space 10 ft. wide which carried a water wheel.

From this time forward the boats were improved with the development of steam propulsion. Impetus was given by the opening up of the New Jersey railroads. At first the ferries were operated independently, but ultimately they were acquired by the railroad companies, additional lines being added to care for the traffic. Now all of the ferries in lower Manhattan are under railroad control. The Edgewater and Dyckman Street ferries to and from Upper Manhattan have been in existence only a comparatively short time and are far less important commercially and industrially than the railroad ferries.

East River Ferries — The first East River ferry appears to have run from Peck Slip, Manhattan, to the vicinity of Fulton Street, Brooklyn. The New York landing was removed from Peck Slip to Maiden Lane about 1700.

Additional landings were established at Coenties Slip and Joralemon Street, Brooklyn, in 1774 and thereafter one line after another was opened up as the traffic seemed to demand it. Steam ferries were tried on the East River about three years later than on the Hudson River, but here again they at first had severe competition from the team boats. It is interesting to note that even the Fulton interests favored the team boats as more easily navigated and safer in winter.

Before the team boats became obsolete "double enders" were introduced, which made it unnecessary as hitherto to turn the vessel around before or after landing. The gears were so arranged that the horses could work continuously in one direction whichever way the boat was going.

As on the Hudson River, the steam ferry ultimately came into its own, since which time there has been improvement with the development of the art of steam navigation. The East River ferries have never been developed to as high a state as those on the Hudson River, because of financial vicissitudes and lessened demand for service after the construction of the bridges over the river. A number of them have been discontinued within the last generation, and, as shown in Chapter 19 on ferries, none of those surviving carries a traffic comparable with that of most of the Hudson River ferries.

Staten Island Ferries — Staten Island's first ferry connections were across the comparatively narrow waters of the Narrows, the Kill van Kull and the Arthur Kill. Apparently there were four ferries, from Long Island, Bergen Point, Elizabethport, and Perth Amboy, in operation before the Revolutionary War.

A steam ferry, making two round trips daily, was established in 1817, in connection with Captain Vanderbilt's through route from New York to Philadelphia. As recently as 1860 the ferries were passing through the kills from Manhattan to Tompkinsville, but ultimately the Staten Island Railway and the lines on the New Jersey mainland rendered the long water route unprofitable, and the terminal for the Manhattan boats was established at or near the present St. George terminal, at the north end of the island. The Manhattan line has been operated by the City of New York since 1905. The length of the run and the more severe weather conditions encountered by these boats have had their influence on the development of the boats, which are the largest ferry boats in the harbor.

TOWBOATS

There remain to help differentiate New York Harbor from any other in the United States if not in the world a great number of towboats, lighters, car floats and other local harbor craft. Car floats are an element of railroad operation and are dealt with historically in Chapter 5. Lighters, while extensively used for other than railroad purposes, are also primarily railroad developments, and are discussed in the same chapter. Towboats, because of their direct service in the moving as well as in the loading and unloading of ships, can best be considered in this chapter.

In the colonial days the small sailing vessels entered the harbor without assistance and came to anchor in the stream, both their cargo and their passengers being

Pier Frontage on Manhattan Devoted to Steamships in Coastwise Service "lightered" in small boats. As it became the practice to dock at wharves, and as the ships became larger and more difficult to maneuver, there grew the first need for towboats.

Towing service was first supplied by small passenger steamboats, which were available chiefly during off hours and dull seasons. For nearly a generation after the invention of steamboats, sailing vessels depended upon such steamboats for towing service. In 1825 what is believed to have been the first steam towboat was built by the New York Drydock Company. Passenger steamboats continued to serve as towboats for some years after this, particularly the older boats displaced in the passenger service by newer models. Gradually, however, the business of towing passed into the hands of companies specializing in the business.

With the construction of the railroads and the adoption of lighterage, there came a further great demand for towboats to move the lighters. This second use was extended to the full navigable length of the Hudson and to the Sound and coastwise service. The tugs that now appear in New York Harbor include ocean-going tugs considerably larger than the transoceanic ships of Hendrick Hudson's time, to say nothing of the vessels that brought Columbus and his band to America in 1492.

The early towboats were sidewheelers. One of the earliest was the *Titan,* a vessel 175 ft. long and of 29-ft. beam, built in 1852 to stand the heavy weather of ocean towing. Screw propellers were built and used to some extent before the sidewheelers came into wide use, but it was some time before they demonstrated their marked superiority. The last sidewheel towboat was removed from New York waters in 1859 when she was sold to New Orleans merchants. Subsequently she was converted into a Confederate gunboat.

The tugboat of today in its highest development is a powerful vessel, built to buck winds, tides and heavy seas, and to haul heavy loads. She may be found flanked on either side by a loaded car float; or towing a ship five times her length through the crowded waters of the Upper Bay and the rivers of the harbor; or conducting three large coal barges through Long Island Sound to New England. She may be seen teamed with another tug drawing an acre or more of canal boats or sand scows down the Hudson. Or she may be seen working with as many as six of her mates warping a 900-ft. ship into her slip. She is as vital to local marine operations as the horse was before motor trucks were known to the moving of goods on the streets.

Chelsea Pier Frontage in Manhattan Devoted to Transatlantic Liner Service

Docking Facilities

For many years the only landing place in New York was the small one near the foot of Broad Street. Ships were not permitted to dock there, but the cargoes — and passengers as well — were transferred between ship and wharf by means of scows, the ship being anchored in the river. These scows were the forerunners of the lighters of today, and the negroes who loaded and unloaded them were the first longshoremen.

1695 — Janvier presents a series of maps of New York, the first one dated 1695, the last 1803. The map of 1695 shows the one dock or basin referred to in the previous paragraph. The Hudson River waterfront was entirely undeveloped. The wall at Wall Street was virtually the boundary between civilization and wilderness.

1729 — The next map, dated 1729, shows expansion far beyond Wall Street, but mainly along the East River. The original dock remained, in addition to which there were numerous small wharves, slips and basins, many of which were devoted to ship repairing and shipyards. There were then just two docks on the Hudson, in the vicinity of what is now Cedar

Street. Most of the territory west of Broadway was taken up with "Kings Farms".

1765 — The third map, dated 1765, records the laying out of numerous streets on the West Side, but the main development was still along the East River, extending beyond Corlears Hook. The Boston Post Road, running northeasterly, was the main thoroughfare. There were some additional piers on the East River, but none on the Hudson.

Even at this time the piers were very short, and most of the waterfront development consisted of quays and basins.

1766–67 — Although only a year or two after its predecessor, the map of 1766–67 reveals the beginning of business activity on the West Side. Three or four small docks are shown, together with Paulus Hook ferry, which we have seen was opened in 1764. Inland on the West Side appear a foundry and a brewery. The East River on this map shows almost continuous waterfront development from the Battery to Corlears Hook.

1782 — The map dated 1782 shows for the first time a long pier on the Hudson River at Vesey Street — a pier longer than any on the East River, which had, however, very little unoccupied space south of Corlears Hook. One or two additional piers are indicated on the Hudson River, bringing the total to five or six.

1803 — The final map of the series, made by the city surveyor in 1803, shows streets laid out or planned for the entire city as far north as 155th Street. There had been much filling of low land and pushing out of the waterfront as compared with the earlier maps.

This map indicates forty-one landing places of one sort or another on the East River as compared with ten or eleven on the Hudson.

Details have not been obtained as to the history of the developments on the Long Island, Staten Island and New Jersey waterfronts, but these developments have taken place mainly in the last hundred years. The gradual shifting in the nineteenth century of the main base of operations from the East River to the Hudson has been a natural process, due to the greater width and depth of the Hudson, its superior alignment, and the entry of the railroads as factors in shipping.

EARLY DOCKAGE RATES

The scale of dockage rates at the public wharves at the close of the seventeenth century, as given in Valentine's "History of New York," published in 1853, was as follows: For vessels of 1 to 5 tons, six shillings; 5 to 10 tons, nine shillings; 10 to 15 tons, twelve shillings; 15 to 25 tons, 1 pound; 25 to 50 tons, 1 pound 10 shillings; more than 50 tons, 2 pounds 10 shillings. The rates, be it understood, did not cover any berthings, inasmuch as ships did not dock at the pier; they merely embraced the right to use the wharf as a lighterage wharf. The wharf was shedded only a short distance beyond low water, says Valentine (probably two blocks inland of the present bulkhead line), and even scows could land only at the end of the pier. The first mention of the wharf is in 1664, and it is stated to have been the only one as late as 1666. It was extended fifty feet in 1669.

FREIGHT BROKERAGE AND FORWARDING

An important element of the conduct of shipping at the Port of New York is the freight brokerage and forwarding business. G. W. Englehardt in "New York, the Metropolis" describes the procedure briefly as follows:

> "Where, as here in New York, so much foreign business is carried on, the forwarding and freight brokerage business assumes uncommon importance.
>
> "About thirty-five or forty houses figure here as freight brokers, and most of them are forwarders also. The business of the freight broker is to secure favorable rates for the shipper from the steamship lines direct and connecting. He looks to the transportation agency for compensation, and attends to all the formalities with which the shipper may be unfamiliar. His clientele consists largely of inland manufacturers seeking a market for their surplus output abroad.
>
> "But the forwarding branch of the business is the more important. Export and commission houses do their business largely through the forwarder. He takes full charge of goods, attends to hauling, etc., and sees that the goods reach destination. He maintains offices in London and in other cities overseas, and is sometimes the middleman for foreign railroads. Through him rates may be obtained to any city or town on the other side. A market replete with home-made goods is his harvest, for then the movement sets in to sell the factory surplus abroad."

SHIPBUILDING AND REPAIR PLANTS

Shipbuilding was an important industry at the Port of New York in the colonial days, and in fact up to the middle of the nineteenth century, until the passing of the clipper ship. Since then the Port had not been as active in this line as her commerce would warrant until the recent war, when yards were opened up here and at available sites all up and down our coast in the effort to offset the destruction caused by the German submarine fleet. The activities of these yards have largely subsided since the signing of the armistice, and it remains to be seen whether New York and the country will be content to trail their European rivals as before the war in the building of ships to handle the world's trade.

New York has some fifteen drydock and marine railway plants for ship repair work. None of them, however, are capable of handling the largest liners, and few can accommodate the average freighter. They are suited in the main to the handling of tugs, lighters, yachts and the smaller craft.

CHAPTER 5
History of New York's Railroad Development

All but one or two of the railroads entering the Port of New York are old railroads, dating back to the time when the construction of twenty-five miles of railroad was a large undertaking. All but one or two have been created by the piecing together of short lines, not always so related to each other as to form a strictly logical system. Hardly one of them reflects any early attempt to obtain a favorable position for handling the transcontinental business of the first port of the land. Early financial difficulties militated further against provision while there was opportunity to handle to the best advantage the enormous tonnages to come.

And yet all of these railroads are new, as time is recorded in history. They have come, some of them as pitifully small projects, and have expanded over the entire port and hinterland, and have clung to terminal facilities and methods so inadequate as to seem medieval — and yet it has all practically happened over night. A century ago there were no railroads. New York was here, only a twentieth of its present size, but acquiring importance through the beginnings of its water-borne commerce. Eighty years ago there were a few "streaks of rust" running short distances from the Port, but few had the hardihood to propose that the railroad try to compete with the inland waterway. By this time the Erie Canal had virtually marked New York to be the country's chief port. Fifty years ago it had become evident that the railroads could compete with the inland waterways, and several of the "streaks of rust" had grown into trunk lines; yet their owners were only coming to realize that something better was needed in the way of terminal service than lighterage by contract with private companies, and they were beginning to build car floats and to open pier stations. And by that time the railroads were hedged in by the urban development they had helped bring about, and the opportunity had passed for a better planned terminal system except at enormous cost and by joint action.

In short, the Port of New York was waiting for the railroads when they came; and when they came, the Port grew beyond the most optimistic visions of the railroad pioneers, beyond their financial capabilities to provide for handling the resultant business, beyond the possibilities for relief offered through the advancement of the art of engineering in the matter of bridges, tunnels and terminals. Never able to catch up, the railroad operators were forced to content themselves with certain local improvements in a very imperfect system of terminal operations.

Growth of the Railroads

It was in 1851, only 69 years ago, that the Erie, which may fairly be called New York's first trunk line, ran its first train through from the Hudson River to Dunkirk on Lake Erie. It was no longer ago than 1892 that the Lehigh Valley likewise pushed its way through to Lake Erie. In 1851 what is now New York City had a population of not more than 700,000, and the total population of the Port District was barely 900,000. In 1892 the corresponding figures were approximately 2,700,000 and 3,650,000. Now they are about 5,600,000 and 8,000,000.

ERIE — NEW YORK'S FIRST TRUNK LINE

Strangely enough, the first of New York's railroads to attain the dignity and importance of a trunk line was built as a single project, and not by the joining up of fragmentary lines. In 1832, when the total railroad mileage in the United States was only 130 miles, the New York & Erie Railroad Company was incorporated to build a line across the southern part of New York State, and surveys were made almost immediately. Financial and engineering difficulties were encountered, and it was 1841 before the first 46-mile section, from Piermont on the Hudson to Goshen, was opened, the State of New York having meanwhile loaned the company $3,000,000 to hasten the work of construction. From that time on, however, the work proceeded more rapidly than on most other lines in those days, and on April 22, 1851, the opening of the entire line from Piermont to Dunkirk, on Lake Erie, a distance of about 450 miles, was celebrated as a national event. This was then the longest single railroad in the world.

Twelve years later a line to Buffalo was acquired by purchase, and in 1883, the New York & Erie Railroad Company having meanwhile passed through a receivership, a through line to Chicago was obtained through the acquisition of the New York, Pennsylvania & Ohio Railroad. The line to Dayton, Ohio, was acquired about the same time. Out of another reorganization in 1895 grew the present corporation, the Erie Railroad Company.

Entrance to Jersey City — Less can be said for the vision of the Erie pioneers in the matter of eastern terminals than in that of transcontinental facilities. Both topography and political boundaries seemed to them to point to Piermont, some 22 miles north of Jersey City on the west bank of the Hudson, as the site for their rail terminal. Here was the most southerly break in the high hills flanking the river, the precipitous Palisades beginning at that point and extending south virtually unbroken to a point opposite the extreme south end of Manhattan Island. Here also was the most southerly site for a terminal within New York State — and in its beginnings the Erie was distinctly a New York enterprise, built under a New York charter with the aid of a loan from the State. Hence its promoters thought it satisfactory to locate its railhead at Piermont and install a line of steamers for both passengers and freight from there to a pier at the foot of Duane Street in Manhattan.

Other interests thought differently as to the adequacy of this arrangement for the business to come. They built a line, or a series of three short lines, from Jersey City to Suffern on the line from Piermont, and undertook to prove the superiority of an all-rail service with only a short ferry across the Hudson. Then followed a bitter warfare, in which the Erie, besides speeding up its steamers, first denied the New Jersey lines a physical connection at Suffern, and then established the same rates from Suffern west as from New York west.

Despite these handicaps, the New Jersey lines proved their case, and in 1852 the Erie came to terms and acquired by lease the three offending lines. From then until 1862 the Erie passenger trains used the Jersey City station of the New Jersey Railroad & Transportation Company (now a part of the Pennsylvania), while the Erie continued to handle its freight at Piermont. In 1862 the company opened its own terminals at Jersey City, and transferred most of its freight business to that point.

Thus the first trunk line of the Port established an all-rail line to the heart of the Port only when it was forced to do so, and did not equip itself to handle freight there in cars until fifteen years after the predecessors of the New York Central had obtained permission to build a line almost the length of Manhattan.

New York, Susquehanna & Western — The New York, Susquehanna & Western Railroad was formed in 1881 by the amalgamation of a number of short lines built in the 70's and early 80's in northern New Jersey. At that time it extended from Marion on the Pennsylvania, 2½ miles from Jersey City, to Gravel Place, near Stroudsburg, Pa., where it connected with the Delaware, Lackawanna & Western Railroad. Another part of it ran to Unionville, N. Y., and was subsequently extended to Middletown, N. Y. In 1892 it acquired the Wilkes-Barre & Eastern Railroad, which was then under construction, and completed it the following year from Stroudsburg to Wilkes-Barre. The Erie acquired the New York, Susquehanna & Western by lease in 1899.

The New York, Susquehanna & Western handles most of the Erie's coal business. It has a separate coal terminal at Undercliff, N. J., about opposite 110th Street, New York.

Other Local Feeder Lines — The Erie has several other short lines coming to New York, which give it the most extensive local feeder system of any railroad in the Port. They include the Northern Railroad of New Jersey, the New Jersey & New York Railroad, the Newark branch and the Greenwood Lake branch.

Some of these short lines are nearly as old as the Erie itself. The Northern Railroad of New Jersey, chartered in 1854 and opened in 1859, was subsequently leased by the Erie. It ran 21 miles from Bergen Junction on the Hackensack Meadows through Sparkill on the old Erie line to Piermont, whence a four-mile extension was immediately made to Nyack. The New Jersey & New York Railroad, itself a consolidation of earlier roads, the first of which was chartered in 1858, is another of the Erie subsidiary lines. It extends from Rutherford Junction to New City, N. Y., 25 miles, crossing the original Erie at Nanuet, while a branch also reaches Haverstraw, N. Y.

These lines are east of the Erie's present main line. West of it an independent line from Paterson south to Newark, and another running west from Bergen Junction to Newark, were combined after the Erie acquired them to form the Newark branch of the Erie. Bearing still further west is the Greenwood Lake Branch, chartered in 1878 as the New York & Greenwood Lake Railroad. It is 45 miles long, with short branches to West Orange and Essex Fells, New Jersey.

The Erie ranks fourth in mileage of the railroads entering the Port. In the main it occupies territory intermediate between that of the New York Central and the Pennsylvania, although all three roads reach many of the same points. Besides Buffalo and Chicago, the Erie reaches Cincinnati, Cleveland and the Youngstown district, and through its subsidiary, the New York, Susquehanna & Western, as well as through a branch line of its own, it taps the coal fields of northeastern Pennsylvania.

Like most of the other railroads of the Port of New York, the Erie has within the Port District pier and inland rail stations reached only by car float, as well as passenger and team ferries. These will be referred to more fully under the heading of New York terminals. It also has within the Port District, besides the main and feeder lines mentioned, a 9-mile detour around Paterson for main-line freight, a connection with the Pennsylvania at Marion Junction and tracks to the Erie's waterfront terminal at Weehawken.

NEW YORK CENTRAL AND WEST SHORE

While the Erie was being pushed through the New York Central was coming into being as a trunk line by quite a different process, through the joining of ready-made lines which, while not forming a direct route to the West, had an advantage in avoiding the mountain ranges farther south. By 1853 the lines had attained the status of a through route, although ferry service at Albany was depended upon until 1866, and consolidation of the lines meeting at that point came three years later.

Impetus for this development was furnished by the competition of Boston, because there was rail connection between East Albany and Boston about ten years (in 1841) before there was similar connection between East Albany and New York, and the outlet to Boston, while 50 miles longer than the present line from Albany to New York, was in a direct line with the chain of railroads across New York State. Thus the New York Central of today, as far as New York City is concerned, grew out of a successful effort to intercept traffic that threatened to go elsewhere, rather than out of any carefully developed plan for a direct or otherwise advantageous route to the West. The result is what is known as the "Water Level Route" — a line that is seemingly indirect, and longer than several of its competitors, but that avoids their higher summits and so is able to hold a large share of the traffic.

The first link of the New York Central chain was the second railroad to be built in the country, the Albany and Schenectady line, opened in 1831. The

Utica and Schenectady line was opened five years later, and by 1842 it was possible to travel from Albany to Buffalo entirely by rail. A passenger had to ride on seven different railroads, however, changing cars six times, changing stations nearly as many times, and consuming more than thirty hours. These inconveniences were overcome in 1853, when all of the lines were consolidated to form the New York Central Railroad.

In the early days there was strong doubt as to either the possibility of railroads competing successfully with water routes, or the propriety of permitting such competition if possible. The Erie Canal had just been built, and to protect it the State first prohibited the rail lines from carrying freight, later allowed them to carry it only during the closed season of the canal, and still later extended the privilege to cover the entire year, but charged the companies tolls equal to the canal tolls. Meanwhile, although efforts were made as early as 1832 to build a railroad from New York to Albany, and a roundabout route (via Bridgeport, Conn.) was actually opened for service in 1842, it was ten years later before the present direct line of the New York Central was completed.

Hudson River Railroad — In 1846, despite the opposition of the navigation interests on the Hudson, the Hudson River Railroad Company was chartered. The road was opened from New York to Poughkeepsie late in 1849 and from Poughkeepsie to East Albany in 1851. The ferry service at Albany was replaced in 1866 by a bridge, and the two roads coming together at the bridge were consolidated in 1869 to form the New York Central & Hudson River Railroad. Control of the Lake Shore & Michigan Southern Railway was acquired in 1873, giving the company a through route to Chicago.

The charter of 1846 granted the right, subject to permission from the City of New York, to build a line down the West Side of Manhattan. That permission was given the next year, and the West Side tracks were laid as part of the Hudson River Railroad. The line handled passenger as well as freight business, inasmuch as the Park Avenue line to what is now Grand Central Station belonged to an entirely different company, the New York & Harlem Railroad Company. The Hudson River Railroad Company established a passenger station at Chambers Street, but drew its passenger cars by horses between that point and Thirtieth Street.

The company's freight traffic grew to such an extent that the company was forced to find a site inland from the waterfront for a downtown terminal. On this site, at Beach and Varick Streets, was built the St. Johns Park Terminal, after which, in 1868, the tracks south to Chambers Street were removed. In 1871, the same year the first Grand Central Station was completed at Fourth Avenue and Forty-Second Street, the Spuyten Duyvil & Port Morris Railroad, connecting what had then become the New York Central & Hudson River Railroad with the New York & Harlem Railroad, was opened, and the Central transferred its passenger trains to the new route. Since that time the West Side line has been used almost exclusively for freight, express and milk business.

New York & Harlem Railroad — The Hudson River Railroad was not the first line of the present New York Central system to enter New York City. The New York & Harlem Railroad preceded it by fifteen years, but as a short, rapid-transit line within the confines of Manhattan. The New York & Harlem shares with the Camden & Amboy, running across New Jersey from South Amboy and now a part of the Pennsylvania Railroad, the distinction of being the first railroad within the Port District of New York.

Chartered in 1831, the New York & Harlem Railroad was to be built from Twenty-third Street to the Harlem River. A few months later extension southward was authorized, with the stipulation that only horse power should be used south of Fourteenth Street. A section from Prince Street to Fourteenth Street was opened in 1832. Engineering difficulties held back the completion of the line to the Harlem River until 1837. Williamsbridge (now a part of New York City) was reached in 1842; White Plains in 1844.

While the New York & Harlem itself was originally a local enterprise, its builders pointed to its possibilities as "the main trunk of a mighty system of internal communication whose branches are to extend throughout our own State, throughout New England and the whole interior of the West." In 1845, three years after the Housatonic route to Albany (via Bridgeport) had been opened, and three years also after surveys for a line on the east bank of the Hudson River had been started, the New York & Harlem was authorized to extend its line to East Albany, or to a junction with any other road reaching East Albany. The building and opening of this extension along the interior of the counties east of the Hudson were almost simultaneous with the building and opening of the Hudson River Railroad, the full extension to Chatham, where connection was made with what is now the Boston & Albany, being completed in 1852.

The road seems to have been located with a view to avoiding the water competition of the Hudson River. The Hudson River Railroad soon distanced it for traffic, however, and the interior line never assumed great importance except as it owned an entrance to the city sought by the New York Central interests for passenger purposes. Having only a small freight business, and never permitted to run locomotives south of Fourteenth Street, it was crowded back as the city expanded northward, until the fixing by city ordinance of Forty-Second Street as the southern limit for the use of steam locomotives led to the erection of the first Grand Central Station at Forty-second Street and the subsequent leasing to the Metropolitan Street Railway of the line south of that point. The first Grand Central Station was completed in 1871, and the same year, as already stated, the New York Central transferred its passenger trains to that terminal. Two years later, in 1873, the New York Central leased the New York & Harlem Railroad and assumed the operation of it.

West Shore Railroad —About 1875 the first steps were taken toward the building of the New York, West Shore & Buffalo Railroad, a line intended to compete with the New York Central all the way from New York to Buffalo. The road was completed in

1883. It derived its name from its occupancy of the west shore of the Hudson River, the New York Central occupying the east shore. At no point in its entire length was this road more than 15 miles from the Central, and much of the way they were within sight of each other.

The completion of the new road resulted in a severe rate war, which forced the newcomer into a receivership. The New York Central purchased a majority of the stock of its rival, which was reorganized as the West Shore Railroad, and in 1885 the Central leased the entire property on a long-term lease. Since that time the West Shore has been operated as part of the New York Central system. Because of its physical parity with the other New Jersey railroads, with its railhead on the west bank of the Hudson River, it has to be considered as an individual railroad in the analysis of several of the plans contemplated for the improvement of the Port.

During and after the periods mentioned the New York Central interests, by purchase or lease, acquired an extensive feeder system, both east and west of Buffalo. On December 23, 1914, the Lake Shore & Michigan Southern Railway and a number of the other controlled lines were consolidated with the main company to form the New York Central Railroad Company. Other "New York Central Lines" outside of this company, notably the Cleveland, Cincinnati, Chicago & St. Louis to Cincinnati and St. Louis, the Pittsburgh & Lake Erie to Pittsburgh and the Michigan Central to Detroit and northern Michigan, as well as to Chicago, make the New York Central system one of the largest in point of traffic entering the Port of New York. The system extends to Montreal, Ottawa and Toronto, and to the Pennsylvania soft coal fields, as well as to and through the populous districts along its main stems. Through its control of the Boston & Albany Railroad the New York Central has an outlet to Boston as well as to New York.

The New York Central's rail lines within the Port as at present operated consist of the main passenger line from Grand Central Station via Mott Haven Junction and Spuyten Duyvil to the northern limits of the district; the West Shore roughly parallel thereto on the New Jersey side, from Weehawken north; the West Side freight line from Spuyten Duyvil to St. John's Park; the Harlem division, from Mott Haven north through White Plains; the Port Morris branch of this line to Port Morris on the upper East River; the Putnam division, formerly the New York & Putnam railroad, a secondary line between the Hudson and Harlem divisions, running north from Sedgwick Avenue, on the east bank of the Harlem River opposite 157th Street; and the New Jersey Junction Railroad, a freight belt line running north and south from Weehawken.

PENNSYLVANIA

In many respects the history of the Pennsylvania system resembles that of the New York Central. There was the same piecing together of short railroads, the same slowness to build railroads where waterways were available. The Pennsylvania pioneers subordinated railroading to water navigation to the extent that one stretch of line between Philadelphia and Pittsburgh was built to carry canal boats over a watershed.

Two railroads in New Jersey that afterward became part of the Pennsylvania system were among the earliest railroads in or near the Port of New York, and both played an important part in the 30's. They were the Camden & Amboy Railroad, the first railroad across New Jersey, and the New Jersey Railroad & Transportation Company, one of the earliest terminal companies anywhere.

The Camden & Amboy, chartered in 1830, was opened in 1832 from South Amboy on Raritan Bay to Bordentown on the Delaware River, and in 1834 from Bordentown to Camden. Passengers went by boat from New York to South Amboy, and also crossed the Delaware by ferry. Meanwhile in 1834 the Philadelphia & Trenton Railroad was opened between those two points. In 1837 the Camden & Amboy acquired that line, and in 1839 it completed a new line from Trenton to New Brunswick, whence it had access to Jersey City via the tracks of the New Jersey Railroad & Transportation Company. Thus the Camden & Amboy controlled the only two lines between New York and Philadelphia.

The New Jersey Railroad & Transportation Company, incorporated in 1832, built from Jersey City to Newark in 1834, to Elizabeth in 1835, to Rahway in 1836 and to New Brunswick in 1837. It furnished terminal facilities for the Camden & Amboy, the Central Railroad of New Jersey, the New York & Erie and the Morris & Essex (now part of the Lackawanna system), and it charged them well for the facilities. In the course of time all of the tenants except the Camden & Amboy built terminals of their own, while the Camden & Amboy and the terminal company itself were leased by the Pennsylvania Railroad. Up to 1853 the ferry from Jersey City to New York was a separate enterprise.

While these two New Jersey enterprises were holding sway the Pennsylvania Railroad proper was taking shape in Pennsylvania, assisted by the State, which sought to offset New York's advantage in the new Erie Canal by a combination rail-and-water line from Philadelphia to Pittsburgh. The first link in this chain was the Columbia Railroad, chartered in 1828 and opened in 1834 from Philadelphia to Columbia on the Susquehanna River. Thence the route followed the Susquehanna and Juniata Rivers to Hollidaysburg, freight and passengers being conveyed by boat. From Hollidaysburg to Johnstown the Allegheny Portage Railroad carried the canal boats over the mountains, and from Johnstown a canal took the same boats to Pittsburgh and the Ohio River.

This primitive mode of operation proved to be neither cheap nor convenient, and was abandoned soon after an all-rail line was available. The Pennsylvania Railroad, projected originally from Harrisburg to Pittsburgh, was opened from Harrisburg to Lewistown in 1849, from Lewistown to Hollidaysburg in 1850 and from Johnstown to Pittsburgh in 1852, the Allegheny Portage Railroad being utilized as the link from Hollidaysburg to Johnstown. In 1849 the Pennsylvania also leased the Harrisburg & Lancaster Railroad, which connected with the State-owned Columbia Railroad. Thus there was all-rail traffic from Jersey City to Pittsburgh one year before the fragmentary lines across New York State were amalgamated into the New York Central Railroad. But as the bridging of the Hudson at Albany and the further consolidation of the lines east and west of that point were not consummated until 1869, so the consolidation of the lines from New York to Pittsburgh into one company did not take place until 1871. In 1857 the Pennsylvania leased the Columbia Railroad, and in 1871 it leased the Camden & Amboy Railroad and the New Jersey Railroad & Transportation Company. The Trenton-New Brunswick line became the main line.

A bridge was completed across the Allegheny River at Pittsburgh in 1858, and a junction was made with the Pittsburgh, Fort Wayne & Chicago Railroad. Ten years later the latter road, with its terminals in Chicago, became part of the Pennsylvania system. In 1890 the Pennsylvania acquired control of a second line to Chicago, the Pittsburgh, Cincinnati, Chicago & St. Louis (the Panhandle), which also reached St. Louis and Cincinnati.

Independent railroads linked together connected Philadelphia and Baltimore as early as 1838. In that year these lines were consolidated to form the Philadelphia, Wilmington & Baltimore Railroad. The Pennsylvania obtained control of this road in 1881, and of the Baltimore & Potomac Railroad from Baltimore to Washington a little later.

Long Island Railroad—Although the Long Island Railroad is more of a separate entity than the West Shore Railroad or the New York, Susquehanna & Western, it is controlled by the Pennsylvania and can best be considered as part of the same system.

The Long Island is one of the old railroads of the Port. It was chartered in 1834 and completed from Jamaica to Greenport in 1844. It had previously, in 1836, leased the Brooklyn & Jamaica Railroad. With the line completed to Greenport a boat line from there to Providence, whence a railroad ran to Boston, gave a second combination rail-and-water route between New York and Boston prior to the establishing of the first all-rail line in 1849 — the boat line from New York to New Haven, and the railroads from there to Boston via Springfield constituting the first.

The Long Island is the only steam railroad on Long Island. Its line to Long Island City was opened in 1861. Various branch lines have been added from time to time, the most important being the Brooklyn & Montauk Railroad, which was merged with the Long Island in 1889. Before the recent European war the Long Island also operated a steamship line to Montauk. In 1900 the Pennsylvania purchased a majority of the Long Island stock, and while the property is still operated as an independent system, a part of it within the Port District serves the Pennsylvania in its interchange of freight with the New York, New Haven & Hartford Railroad.

Like the New York Central, the Pennsylvania has developed an extensive feeder system between New York, Chicago and St. Louis, and these two roads handle about 50 per cent of the total traffic of the Port. The Pennsylvania has no Canadian connection, but divides with the Baltimore & Ohio and Central Railroad of New Jersey a large southern tonnage coming via Washington.

Break-Up Yard, Hackensack Meadows — First Phase of Handling of the Port's Railroad Freight

Within the Port of New York the rail lines of the Pennsylvania and the Long Island consist of the main passenger line from New Brunswick through Elizabeth and Newark and under the Hudson River to the Pennsylvania Station at Thirty-third Street, New York, thence under the East River to the North Side and Montauk divisions of the Long Island; the line from Manhattan Transfer to the old Pennsylvania Station in Jersey City and to the freight terminals north thereof; the freight connection from Newark across Newark Bay to the company's waterfront terminal at Greenville (Jersey City); a belt line from Bay Ridge (in Brooklyn opposite Greenville) to the New York Connecting Railroad; the New York Connecting Railroad across Hell Gate to the Bronx (owned jointly by the Pennsylvania and the New York, New Haven & Hartford); the Amboy division of the Pennsylvania from Rahway on the main line through Perth Amboy and thence southwest roughly parallel with the main line — the old Camden & Amboy Railroad; a freight detour through Newark; a line of the Long Island from Winfield Junction to a waterfront passenger and freight terminal at Long Island City; lines of the Long Island from Jamaica to terminals at Flatbush Avenue, Brooklyn, and at Bushwick; and several short branches of the Long Island used almost exclusively for passenger service.

Central Railroad of New Jersey

The Elizabeth & Somerville Railroad, chartered in 1831, was completed in 1839 from Elizabethport (that part of the city of Elizabeth adjacent to Newark Bay) to Somerville, N. J. By 1848 the Somerville & Easton Railroad, chartered in 1847, had been opened as far west as Whitehouse, N. J. In 1849 these two roads were consolidated to form the Central Railroad of New Jersey, and in the next three years the line was pushed forward to Phillipsburg on the Delaware River. This gave it a strategic advantage in serving as a tidewater outlet for the two great coal-carrying roads of northeastern Pennsylvania — the Lackawanna and the Lehigh Valley—neither of which at that time had lines of their own to New York. They remained its tenants until 1868 and 1875 respectively, the Lackawanna meanwhile operating on a third rail because of wider gage.

During this period the Central of New Jersey, prospering in its capacity as a connecting link, was not reaching out to any extent. Until 1864, when it completed its bridge across Newark Bay and the extension of its line to Jersey City, it was itself a tenant of the New Jersey Railroad & Transportation Company. As the Lackawanna and Lehigh Valley began to show an inclination to build into New York, the Central of New Jersey sought to increase its traffic by building its own line to the coal fields, and by developing feeders in New Jersey. The line reached Wilkes-Barre in 1868 and Scranton, its present terminus, in 1888.

In 1876, more than forty years after the Camden & Amboy Railroad began doing business between New York and Philadelphia, and five years after the Pennsylvania Railroad acquired the Camden & Amboy, the Philadelphia & Reading, which had been operating in Pennsylvania as early as 1839, opened a line from Philadelphia to Bound Brook, N. J., on the line of the Central of New Jersey. This gave an alternative route between New York and Philadelphia — the route which, used in part by the Baltimore & Ohio as well as the other two roads, is the one all-rail competitor of the Pennsylvania for the traffic from Washington and the South.

The Central of New Jersey and the Philadelphia & Reading have long been closely affiliated financially. The Philadelphia & Reading was the first entrant into the coal fields of eastern central Pennsylvania, its line from Philadelphia through Reading to Mount Carbon having been in service as early as 1842, while the line from Reading to Harrisburg was opened in 1856.

In 1882 the Philadelphia & Reading leased the Central of New Jersey. Financial difficulties a few years later caused a suspension of this arrangement, but from 1891 to 1893 the Philadelphia & Reading controlled both the Central of New Jersey and the Lehigh Valley, and had a virtual monopoly of the anthracite coal traffic of eastern central Pennsylvania. When this combination was dissolved in 1893 the Philadelphia & Reading retained control of the Central of New Jersey. During the recent period of government operation the Railroad Administration operated the two roads as one. Between them they have a network of lines in eastern Pennsylvania and all but the northern part of New Jersey. Connecting also with lines to the west and south, they carry a heavy tonnage, although their own rails extend only a comparatively short distance from New York. The Philadelphia & Reading has its own coal terminal within the Port, at Port Reading, but its miscellaneous business is handled over the Central of New Jersey.

The rail lines of the Central of New Jersey within the Port District consist of the main line from Jersey City through Bayonne, Elizabeth and Plainfield; the Newark branch, from Jersey City to Newark; a line from Newark to the main line at Elizabethport; the New York & Long Branch Railroad from Elizabethport through Perth Amboy and thence southeast to the north Jersey coast resorts; a line along the south shore of the Lower Bay; several short branch lines to the Arthur Kill between Elizabethport and Perth Amboy; a branch line to Constable Hook, Bayonne, and short industrial branch lines in Newark.

Delaware, Lackawanna & Western

In its early days the Delaware, Lackawanna & Western Railroad was a local Pennsylvania railroad, dependent upon rivals at both ends for an outlet — the Erie at Great Bend, Pa., and the Central of New Jersey at Clarksville Junction, N. J. It was put to a further disadvantage by its extra-wide gage, which prevented it from interchanging cars with other roads.

The Delaware, Lackawanna & Western derived its name in 1853 from the consolidation of the Lackawanna & Western and the Delaware & Cobb's Gap railroads. The former was opened in 1851 from Scranton to Great Bend; the latter was building east of Scranton at the time of the consolidation. By 1856 the new company had reached the Delaware River. To effect an entrance to New York a short road known as the Warren Railroad was leased, which connected with the Central of New Jersey at Clarksville Junction. Because of its wider gage the Lackawanna had to lay a third rail on the roadbed of the other road and in addition pay well for its right to operate thereon.

Eighteen years before the Lackawanna & Western was completed an entirely different railroad enterprise had been undertaken in eastern New Jersey. The Morris & Essex Railroad, chartered in 1835, opened a line from Newark to Orange the following year, hauling its cars by horses. In 1837 the line was extended to Summit, and steam power was introduced. A year later the line was pushed westward to Morristown. Financial difficulties overcame it, forcing a foreclosure and sale in 1841, at which time its rolling equipment is stated to have consisted of two locomotives and two passenger coaches. The westward march was later resumed, Dover being reached in 1848 and Hackettstown in 1854. An independent railroad from Newark to Hoboken, purchased in 1863, gave the Morris & Essex a New York terminal, and in 1868 the Delaware, Lackawanna & Western leased the entire Morris & Essex system and became independent of the Central of New Jersey. A short gap had to be closed to join the Lackawanna with the Morris & Essex.

Meanwhile the Lackawanna had no western outlet except via its competitor, the Erie. It consequently pushed westward under separate New York State charters, reaching Binghamton in 1870 and Buffalo in 1882. This virtually ended the growth of the system, whose owners have since pursued a policy of intensive development rather than of expansion. West of Buffalo it depends on traffic arrangements with other roads. It also has comparatively few feeders, but traverses productive areas, including the heart of Pennsylvania's anthracite region.

Its rail lines within the Port District consist of the main passenger line from Hoboken through Newark, the Oranges, Summit and Morristown; an alternative main line (the principal through freight line) leaving the Newark line at the east side of the Jersey meadows and passing through Passaic and Paterson to rejoin the Newark line at Denville, N. J.; and a short branch line from Newark to Montclair.

BALTIMORE & OHIO

The Baltimore & Ohio is the oldest railroad in the United States. Incorporated in 1827, it opened in 1830 the first line in the country constructed for the conveyance of passengers — a section from Baltimore to Ellicott's Mills, some 15 miles. From that time the road was pushed westward with energy and courage rivalling that of the builders of the Erie. Cumberland was reached in 1842, Wheeling in 1853, Parkersburg in 1857, Cincinnati in 1872 and Chicago in 1874. In 1893 the Ohio & Mississippi Railway from Cincinnati to St. Louis was merged with the Baltimore & Ohio system, which was meanwhile extended eastward to Philadelphia.

For many years the Baltimore & Ohio depended on trackage rights over the lines of competitors for its entry into New York, using the Philadelphia, Wilmington & Baltimore between Baltimore and Philadelphia and the Pennsylvania between Philadelphia and New York. This arrangement did not prove satisfactory, and the Baltimore & Ohio began to look for another route. In 1885 it acquired a controlling interest in the Staten Island Rapid Transit Company, and about the same time obtained trackage rights over the Philadelphia & Reading-Central of New Jersey route between Philadelphia and New York. It built a bridge over Arthur Kill and a connection with the Central of New Jersey near Cranford, N. J.: and by 1890 it had its own terminals within the lighterage limits of New York Harbor. Its through passenger trains now use the Pennsylvania Station in Manhattan.

The Baltimore & Ohio has an extensive feeder system in the main just south of the Pennsylvania, but reaching most of the same principal centers from Pittsburgh west reached by the other New York trunk lines. It ranks third of the Port's railroads in mileage.

Aside from its pier and inland stations reached only by car float, its facilities within the Port District consist of a line from the Central of New Jersey at Cranford across Arthur Kill to the waterfront (freight) terminal at St. George, Staten Island, and a line of the Staten Island Rapid Transit Railway down the east and south sides of Staten Island to Tottenville.

LEHIGH VALLEY

Like the Lackawanna, the Lehigh Valley Railroad began its existence in the northeastern part of Pennsylvania, and was extended both ways only after a considerable period of dependence on other and competing roads for through connections. Unlike the Lackawanna, it was unable to acquire a ready-made entrance to the New York district, and was forced to build after the other roads had chosen their sites.

The Delaware, Lehigh, Schuylkill & Susquehanna Railroad was chartered in 1846. The name was changed to Lehigh Valley in 1853, and the line was opened between Phillipsburg and Wilkes-Barre in 1855. A connection was made at Phillipsburg with the Central Railroad of New Jersey, which had recently been completed to that point. The Lehigh Valley thus antedated the Lackawanna by two or three years as a tenant of the Central of New Jersey, which, until 1860, terminated at Elizabethport.

Between 1864 and 1868 a number of short roads in the coal district were absorbed by the Lehigh Valley, besides which the Pennsylvania & New York Canal & Railroad Company was organized to build from Wilkes-Barre north to the New York State line. That road was opened in 1869.

This rapid expansion of the Lehigh Valley made the need for an independent line to New York the more urgent. The company made two attempts in 1871 to obtain that independent line — by the leasing of the Morris Canal and by the purchase of a majority interest in the New Jersey West Line Railroad. The canal, running from Phillipsburg to Jersey City, gave the company a water route with a capacity of 1,000,000 tons per year, and the valuable Morris Canal Basin in Jersey City. The basin later provided waterfront for the railroad's marine terminals in the Port, but the company found the canal itself unsatisfactory in its competition with the all-rail routes. Meanwhile, its control of the New Jersey West Line Railroad, which was open from Summit to Bernardsville, N. J., and chartered from Newark to the Delaware River, was short-lived. Immediately after acquiring the majority interest the Lehigh Valley proceeded to extend the line already built, but the following year the company lost control of it and the work stopped. Subsequently the line was sold to the Morris & Essex Railroad, and the small part built is now a branch of the Lackawanna.

A third attempt to get a real foothold within the Port District was more successful than the other two. The Perth Amboy & Bound Brook Railroad, chartered in 1858, was acquired; a new line, the Bound Brook & Easton, was chartered in 1872 and built, and the two were consolidated as the Easton & Amboy Railroad, on which the Lehigh Valley opened through service in 1875. Passenger trains entered Jersey City over the Pennsylvania from Metuchen, while freight had its terminal at Perth Amboy.

The company had acquired terminal property in Jersey City in 1872 for the New Jersey West Line Railroad. This was the property concerned in the Central of New Jersey-Lehigh Valley litigation which finally terminated in favor of the latter company in 1887. In 1888 a line was completed from South

Plainfield to Roselle, N. J., where a connection was made with the Central of New Jersey, and again for a short period the Lehigh Valley used the Central of New Jersey for its entrance to New York for both freight and passenger traffic.

The next year, however, the Lehigh Valley, through the Jersey City, Newark & Western Railway, built across Newark Bay to a connection with the National Docks Railway, in which the Lehigh Valley had acquired a half interest. The National Docks Railway led to the Lehigh Valley's terminal property in Jersey City, on which the company completed a terminal for freight in 1889. This gave the Lehigh Valley its first entrance to the Hudson River waterfront. A little later an extension for passenger service was completed from Roselle to a connection with the Pennsylvania at Newark, and the Lehigh Valley again became a tenant of the Pennsylvania with respect to its passenger service. For several years recently it used the Central Railroad of New Jersey's terminal, but it is now again a tenant of the Pennsylvania. The Lehigh Valley has never developed a passenger terminal of its own in the Port District.

In 1892, through new construction and the acquisition of existing short lines, the Lehigh Valley opened its extension from the New York State line to Buffalo, and became one of the trunk lines. It has numerous feeders in Pennsylvania and New York, and traffic arrangements west of Buffalo and Suspension Bridge, its western termini.

The Lehigh Valley's rail facilities in the Port District consist of the main freight line from Jersey City across Newark Bay and through Newark and South Plainfield; the coal branch from South Plainfield to Perth Amboy; a short branch to Irvington; and the National Docks Railway, a belt line running from the end of the New Jersey Junction Railroad in Jersey City to Constable Hook, Bayonne.

NEW YORK, ONTARIO & WESTERN

Contrasting with a number of other New York railroads which had their origins in the interior and found it necessary to acquire New York terminals to handle their growing business, the promoters of the New York, Ontario & Western Railway originally controlled a large part of the waterfront of Weehawken and were forced through lack of funds to surrender it. In a period of two years the New York, Ontario & Western interests changed from owners of an attractive entrance into the Port District to tenants paying well for the use of what had been their property. The result is that the New York, Ontario & Western has trackage rights only between Weehawken and Cornwall-on-the-Hudson, a distance of 53 miles, and has no terminals of its own in the Port District with the exception of two coal trestles at the north end of Weehawken yard.

In 1880 the New York, Ontario & Western Railroad was organized to take over the property of the New York & Oswego-Midland Railroad, which was opened in 1871 from Oswego south, and extend it to New York. The same interests had been accumulating valuable waterfront and other property in Weehawken, anticipating the need for this not only by themselves but also by the New York, West Shore & Buffalo Railroad, which was also at the time being promoted. The Ontario & Western interests also acquired the charter for a railroad to be built from Jersey City to Albany. The New York, West Shore & Buffalo Railroad already had a charter for a line from Jersey City to Albany and it was apparent that the two routes would be in conflict as to right-of-way.

To avoid duplication and litigation the Ontario & Western and West Shore interests entered into an agreement whereby the Ontario & Western was to build the North River Railroad from Weehawken to Middletown by way of Cornwall, while the West Shore was to build from Cornwall north. The Ontario & Western appeared to have the upper hand, owing to the dependence of the West Shore on the stretch from Cornwall to Weehawken, including the Weehawken terminals, for its entrance into New York. The North River Railroad was completed in 1883, six months before the West Shore was opened from Cornwall to Buffalo.

By this time, however, the New York, Ontario & Western, in order to raise funds, had been obliged to transfer the North River Railroad to the West Shore and to reorganize the holding company of the Weehawken properties as the West Shore & Weehawken Terminal Company. The West Shore on the other hand gave the Ontario & Western a perpetual lease of the North River Railroad, and the West Shore had to pay for trackage rights from Cornwall to Weehawken. Consolidated bonds were issued covering the entire West Shore Railroad as well as the Ontario & Western as far as Middletown and the Weehawken terminals. Both guaranteed these bonds.

Financial difficulties then befell the West Shore, and in the foreclosure proceedings the New York Central acquired control of the West Shore. This left the New York Central on the one hand with part control of the Weehawken terminals and the line from Weehawken to Cornwall, and on the other hand with claims against the Ontario & Western for unpaid interest on bonds. To extricate itself from the latter difficulties the Ontario & Western Company was obliged to surrender its lease of the North River Railroad Company and its share in the Weehawken Terminal properties, receiving in exchange title to the line from Cornwall to Middletown, trackage rights from Cornwall to Weehawken and exemption from the overdue interest payments.

This complete reversal was consummated before the end of 1885. Neither this arrangement nor the location of the Ontario & Western has been favorable to a large business, and the New York tonnage of the Ontario & Western, handled at West Shore stations except for that handled at the Ontario & Western's piers in Weehawken, is small compared with that of any of the other railroads of the Port. The company has few feeders and a total mileage of less than 500. Its most important branch line, opened in 1890, extends to Scranton and the anthracite coal region. At Oswego it connects with the Great Lakes and with a secondary line of the New York Central running to Buffalo.

NEW YORK, NEW HAVEN & HARTFORD

Occupying the most populous section of the United States, the New York, New Haven & Hartford Railroad is the amalgamation of a large number of independent short lines, some of which were built in the earliest days of railroad construction. The nucleus of it was the Hartford & New Haven Railroad opened in 1839, and the New York & New Haven opened ten years later.

The first section of the present system was the Boston & Providence Railroad, chartered in 1831 and completed in 1835. Two years later a separate line was completed west from Providence to Stonington, Conn., and in 1852 another line from Stonington to Groton opposite New London was opened.

The first railroad construction in Connecticut was a part of the Hartford & New Haven Railroad, which, as previously stated, was completed in 1839. In 1844 this was extended to Springfield. The Hartford & New Haven Company maintained a connection with New York through the Connecticut River Steamboat Company, which it controlled. Meanwhile the Boston & Worcester Railroad, between those two points, was opened in 1835, and by 1841 the Western Railroad Company of Massachusetts had built from Worcester to the New York State line, where a separate corporation completed the connection with East Albany. Thus as early as 1844 New York and Boston were connected by the combination of steamer service from New York to New Haven and rail service the rest of the way.

In 1844, the same year this through combination service was made available, the New York & New Haven Railroad Company was chartered. It completed its line in 1849, connecting with the New York & Harlem Railroad at Williamsbridge and using the entrance of the latter railroad into New York. An agreement was entered into with the Hartford & New Haven Company by which the latter discontinued its day line of steamers to New York and increased the charge on night steamers, the New York & New Haven Company paying the other company for thus reducing the water competition. This gave the first all-rail connection between New York and Boston.

Three years after the completion of the New York & New Haven Railroad still another line, the New Haven & New London Railroad, was opened between those points. Continuous rail service thus became possible in 1852 between New York and Boston by a second route, with the exception of the ferry service across the Thames River at New London.

These various railroads still remained as separate organizations. Consolidation of them dates from 1864, when the lines from Providence to Groton were made one. In 1870 the New York & New Haven Railroad leased the lines from New Haven to New London, and two years later the New York & New Haven and the Hartford & New Haven were consolidated to form the New York, New Haven & Hartford Railroad.

Entrance to the Only Railhead Waterfront Yard on Manhattan Island — This Yard Also Serves as a Break-Up Yard

Thus the new company controlled one line from New York to New London and another from New York to Springfield, together with certain branch lines. The control was extended to Providence in 1892 by the taking over of the New York, Providence & Boston Railroad, which comprised the two lines from Providence to Stonington and from Stonington to Groton. The Boston & Providence was leased to the Old Colony Railroad in 1888 and the New York, New Haven & Hartford Railroad in turn leased the Old Colony Railroad in 1893, and so effected its own entrance into Boston. For some time before that it had had a working arrangement with the New York, Providence & Boston and the Boston & Providence and later the Old Colony Railroad for through traffic between New York and Boston.

Meanwhile the New Haven has absorbed a network of feeders in Connecticut, Rhode Island and Massachusetts, being virtually the only road serving most of its territory. Its large number of branch lines makes its total mileage greater than that of several of the longer lines running west from the Port of New York. It has exclusive control over two lines from New Haven to Boston — the so-called Shore line through Providence, and the Willimantic line — while its trackage rights between Springfield and Boston over the Boston & Albany give it a third route. It owns a number of steamship lines on Long Island Sound, and controls the Central New England Railway, which crosses the Hudson River at Poughkeepsie and connects with railroads reaching into the Pennsylvania coal regions.

The New Haven's rail facilities within the Port District consist of the main passenger line from Woodlawn Junction on the New York Central east through Mount Vernon, New Rochelle and Port Chester; the Harlem River branch, from New Rochelle to the main freight terminal at Port Morris; the New York Connecting Railroad across Hell Gate, which it owns jointly with the Pennsylvania, and the New York, Westchester & Boston Railroad, an electrified passenger line from Port Morris to White Plains and New Rochelle.

PHILADELPHIA & READING

One other road to be accounted for is the Philadelphia & Reading Railway. This road is not a competitor of the others for general New York traffic. It is closely affiliated with the Central Railroad of New Jersey — the Railroad Administration operated the two roads as one — and its general merchandise business in the Port of New York is embraced in that of the Central of New Jersey. To handle its large coal traffic at the Port, however, it established its own terminal at Port Reading on the Arthur Kill, and completed its own line thereto in 1892 from Bound Brook, its junction with the Central of New Jersey.

These constitute the Philadelphia & Reading's only facilities within the Port. It has no pier stations, no marine equipment. The road is important to the Port apart from its coal business, however, because it honeycombs southeastern Pennsylvania and supplies the Central of New Jersey with a large traffic, and because in conjunction with the Central of New Jersey it affords the Baltimore & Ohio its entrance to New York from Philadelphia north.

Evolution of New York's Terminal System

New York's railroad terminal system, even more than the railroads themselves, shows the efforts of men, with no precedent to guide them, never quite able to realize the power of their new tool, and never quite able to keep ahead of the traffic it was creating. As the railroads as a whole had their beginnings in small ventures, so the early terminal operations were crude, and quite different from those of today. While several lines came into existence in the early 30's, they found it satisfactory for many years to transship all freight at the rail terminals, and rely on private companies to do the lightering. The first car float did not make its appearance until 1866, and by the time, perhaps fifteen years later, that the car-float pier-station system had become established, there was, as previously pointed out, hardly any other way for the individual railroad to solve the terminal problem. Consequently the present new-old system has undergone little change in forty years.

There may be said to have been four steps in the development of the railroad terminal system as now in effect at the Port of New York: (1) Establishing of tidewater terminals in the general vicinity of New York and steamer service between these terminals and New York; (2) extension of the rail lines to points in or directly opposite Manhattan, largely by independent terminal companies; (3) inauguration of car-float service, and (4) creation by the railroad companies of their own car-float and lighterage service. What might be considered a fifth step, but which was more in the nature of a gradual evolution running through the entire life of the railroads, is the development of the lighter and the lighterage system.

STEAMER SERVICE TO DISTANT TERMINALS

The same deference to the superiority at that time of water transportation that retarded the development of the New York Central, Pennsylvania and New Haven systems is evidenced by the history of New York's terminal development. Apparently it was thought sufficient to reach tidewater in the vicinity of New York, and depend on steamer service to bridge the gap to the city itself. The Camden & Amboy, the first of the New Jersey railroads, established its terminal at South Amboy. The Central of New Jersey chose Elizabethport, and used that point as its freight terminus for some twenty-five years, although it in the course of time acquired trackage rights for passenger trains over the New Jersey Railroad & Transportation Company to Jersey City. The Lackawanna, while a tenant of the Central of New Jersey, built terminals, mainly for coal, at Elizabethport. The owners of the Erie, who located their eastern terminus at Piermont on the Hudson, actually fought attempts to force them into Jersey City by cutting the water rates and proclaiming the superiority of their boat service between Piermont and New York.

Four steamers constituted the marine equipment of the Erie during this fight. Three of them carried both passengers and freight; the fourth carried only milk. The Central of New Jersey had three steamers in the early days — two for both passengers and freight, the other for freight only. It is evident, therefore, that the traffic was still of small dimensions. It is interesting to note that the landing places of the steamers in New York were at the foot of Duane Street and at the foot of Cedar Street, the sites of the principal Hudson River pier stations of the present day of the Erie and the Central of New Jersey respectively.

In 1840 the population of Jersey City was only 3,072, and that of its neighbor cities on the west bank of the Hudson was nil, so that there was no incentive for the railroads to come to their present terminals except their nearness to New York City, which itself in 1840 had less than a tenth of its present population. Inasmuch as car floats and modern ferries for transferring goods short distances en masse were unknown, it is not strange that the pioneers regarded a 25-mile voyage as little more objectionable than a one-mile voyage.

FIRST TERMINAL RAILROADS

If the establishing of railheads on tidewater within the New York district and steamer service from there to New York is to be considered the first step in the Port's rail-terminal development, the second was the independent promotion of terminal railroads reaching to points directly opposite Manhattan. The two main projects of this character were the New Jersey Railroad & Transportation Company and the series of railroads (the Paterson & Hudson River Railroad, the Paterson & Ramapo Railroad and the Union Railroad) reaching from Jersey City to Suffern on the Erie. The part played by these railroads has already been set forth in the histories of the Pennsylvania and Erie railroads, which ultimately absorbed them.

The promoters of these independent projects had foresight apparently not possessed by the builders of the longer lines reaching into the interior. The New Jersey Railroad & Transportation Company was early in the field, and for some years it collected from three tenant railroads. Originally these terminal roads were used for passenger traffic only, freight being left to depend upon the long water haul to and from the old terminals. By 1862, however, when the Erie had opened independent freight terminals in Jersey City and the Central of New Jersey, pushing its own line north from Elizabethport, was about to do the same thing — the Hudson River Railroad having meanwhile perhaps given the thought impetus by building into the heart of Manhattan — the principle may be said to have been established that the water haul must be minimized and freight as well as passengers be brought within hailing distance of New York.

CAR FLOATS

Shortly after the railroads adopted the principle of waterfront freight terminals as near New York as possible, the car ferry followed as a natural development. The first car float made its appearance in 1866. Details are lacking as to its exact dimensions or construction, but it probably was only smaller and not very different from the oldest wooden floats now in the harbor. It is thought to have had two tracks with a capacity of three cars on each track. Cars were then as now got on and off the float by means of hinged bridges. Tugboats hauled the floats and either placed them alongside piers where the cars were unloaded and loaded direct, or took them to other float bridges, by means of which the cars were hauled off the floats.

Except in sizes and capacities of the car floats and tugboats, the magnitude of the operations, and the fact that each railroad now maintains its own fleet of floats and tugboats, car-float service is today substantially what it was when inaugurated fifty-odd years ago. A relatively small number of existing floats are of steel, and upward of 300 ft. long. The majority of them, however, are of wood, and shorter. Those in interchange service usually have three tracks; those in pier-station service have two, with an intermediate trucking platform. The corresponding car capacities range from twelve to twenty-four cars and from eight to sixteen cars. Tugboats have of course increased greatly in average power and speed since 1866.

RAILROADS OPERATE OWN CAR FLOATS

When car floats were introduced in the harbor the railroads were relying on contracts with outside lighterage companies for the moving of goods about the harbor. The contracts generally called for the movement of the floats only between the railroad terminals in New Jersey and the various railroad pier stations, at a certain sum per ton of freight moved. The railroad companies, however, often desired to make deliveries to or pick-ups from large consignees or shippers at other points — a service which was not profitable to the private companies. In consequence the private companies to a large degree dropped out of the car-float business, and the railroads were forced to establish their own service.

Now the few private companies operating car floats do so in connection with private terminals which replace the railroad stations. There are some eight of such private companies in different parts of the harbor.

RAILROAD LIGHTERAGE SERVICE

During the first stage of the Port's railroad development, when steamers afforded the connection between New York and Piermont, Elizabethport and South Amboy, the railroad companies handled their small freight traffic along with their passengers on their own steamers. Later, when they were bringing their passengers by rail nearer their destinations, and the freight traffic had grown to a larger volume, they came to rely upon contracts with outside companies for the water transshipment of the freight.

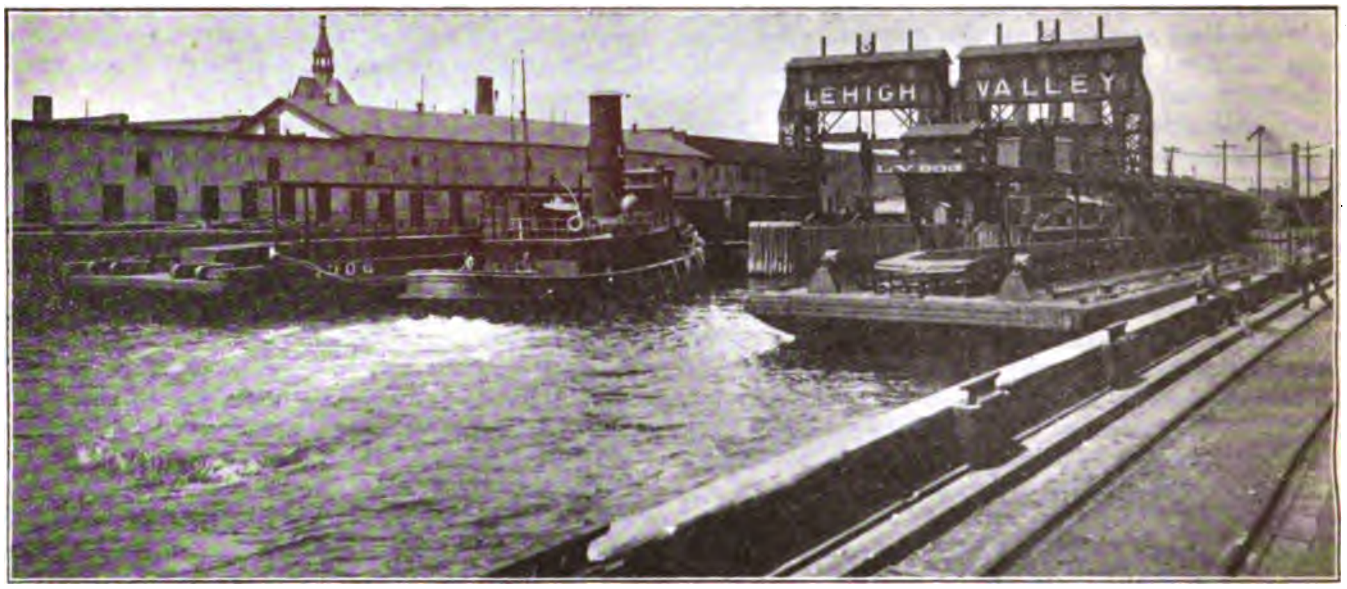
Prior to the introduction of the car floats, these companies handled the freight in primitive craft, the progenitors of our present lighters. Some of these were propelled by sails. Others depended on tugboats. Practically none had steam power. Practically none, even those with sails, had derrick booms, although the masts were used in connection with hand-operated winches for swinging the cargo aboard. The construction of the lighters was equally crude; many of them were without decks and showed the inside ribs and reinforcing of the hulls. They averaged perhaps 100 tons in capacity.

Then came the introduction of the car float and the early taking over from the private companies of the car-float service. For some time after this the railroad companies continued to contract with the private companies for the handling of their lighterage business. In the course of time each railroad established its own fleet of lighters. The private companies remained in the field, and are there in large numbers at the present time, finding much opportunity for serving steamships besides sharing in the railroad business; but each railroad (with the exception of the New York, Ontario & Western and the Philadelphia & Reading) maintains a considerable fleet of lighters as well as tugboats and car floats.

NEW YORK FREIGHT STATIONS

As we have already seen, the landing places for the early steamers of the Erie and the Central Railroad of New Jersey were retained by those companies and became the sites of important pier stations. The

Commission has not deemed it necessary to delve into the records to determine just what in the way of pier stations or designated piers the New Jersey railroads had in the early days in New York for handling their freight traffic. Before the advent of the car float, when lighters of small capacity were, aside from the ferries, virtually the sole means of getting goods across the Hudson River or the Upper Bay, there may have been no commanding reason for concentrating the business at established stations. Possibly the traffic was not yet large enough to warrant any considerable number of stations. In any event the earliest reports of the Dock Department of the City of New York, which was created in 1871, show few piers in the hands of the railroads.



Tugboat and Two-Track Platform Car Floats at Transfer Bridges in New Jersey Waterfront Yard

While the first car float had appeared five years before this, there were probably not many in existence at that time; in fact, at least one New Jersey railroad then operating at the Port did not introduce car-float service before 1880. Consequently the system of maintaining freight stations on piers, mooring car floats alongside the pier and unloading and loading the cars without removing them from the floats was in its infancy.

1873—In 1873 it appears that the only pier stations in Manhattan were two held by the Pennsylvania interests, at Morris Street and Desbrosses Street respectively; two maintained by the Erie, in the vicinity respectively of Chambers Street, Hudson River, and Coenties Slip, East River; one held by the Central of New Jersey at or near Cedar Street, Hudson River, and one operated by the New York Central between Moore Street and Coenties Slip, East River. The New York Central thus early supplemented its all-rail service with water service in its competition with the other roads, but began by serving a part of Manhattan not reached by the West Side rail line. In this same year 1873 the New York Central acquired the site for a pier at Thirty-third Street, Hudson River, but this was presumably intended as a lighterage pier.

1876—A map published in 1876 by M. Dripps shows considerable expansion of the pier-station system on the Hudson River below Twenty-third Street. The Pennsylvania then had four piers in the vicinity of Morris Street and one at Hubert Street, the Erie had two at Chambers and Duane Streets (as at present) and a third at Franklin Street, the Central of New Jersey had a second pier at Cortlandt Street, and the Lackawanna (then the Morris & Essex Railroad) had one at Clarkson Street. In all there were eleven Hudson River railroad piers south of Twenty-third Street as compared with twenty at the present time; but there were very few elsewhere in Manhattan. One of the few was the first pier station of the New York, New Haven & Hartford, at the foot of Montgomery Street, East River. Another was the first pier station of the Long Island Railroad, at Catherine Street, East River.

In this year we have the first evidence of the inadequacy of the New York Central's all-rail line into Manhattan, in the leasing of land under water for a pier station at Barclay Street, Hudson River, only a short distance from the St. Johns Park terminal of the rail line. The station at Barclay Street was opened in 1878.

1879—A map published in 1879 shows other new railroad piers on the West Side, together with changes of control. The Lehigh Valley, having recently reached a connection in New Jersey with and become a tenant of the Pennsylvania, had Pier 2, one of the group of four in the Morris Street district previously held by the Pennsylvania. The Central of New Jersey had four piers together from Rector to Cedar Street, Cortlandt Street having been given over to ferry uses. The Lackawanna had one at Dey Street. The New York Central had its new pier at Barclay Street, the Erie had its two at Chambers and Duane Streets, the Pennsylvania had its one at Hubert Street, while the pier at Clarkson Street (now Pier 40, not a railroad pier) had passed from the Lackawanna to the Central of New Jersey.

1880–1890 — The next few years saw the expansion of the Pennsylvania's station at Hubert Street by the addition of two more piers, at Laight and Vestry Streets. The Lackawanna acquired a new pier at Leroy Street. The New York Central expanded its Barclay Street station by the addition of the pier at Park Place. By 1890 the Baltimore & Ohio and the West Shore had obtained pier facilities and the Erie and the Lehigh Valley had both increased their Hudson River facilities, while the New York, New Haven & Hartford had expanded its East River station.

Since 1890 — From 1890 to the present day each road has added new facilities as would be expected to accommodate the increasing traffic. While there have been a few additions in the lower West Side, they have been mostly above Twenty-third Street on the Hudson, and in the East River. Manhattan railroad tonnage figures for the last fifteen years, assembled by the Commission's statistical force and presented in Chapter 6, show that the new East River stations have relieved the downtown West Side stations and kept the tonnage of the latter about uniform, while the newer uptown stations have shown rapidly increasing traffic as business has expanded northward. A few downtown stations have been abandoned.

Other Boroughs — Brooklyn, a separate municipality in 1870, had a population according to the census of that year of 419,921. Following the establishing of car-float stations in Manhattan others were opened in Brooklyn, where, including inland rail stations, there are now eight. There are also three inland rail stations in the Bronx.

Inland Rail Stations — Ordinarily railroad freight stations, adapted only to the handling of miscellaneous freight in relatively small and clean packages, are supplemented by team tracks, one or more of which are spanned or flanked by cranes. Here bulk freight, heavy machinery and other goods not conveniently or safely handled in freight houses can be transferred direct between car and truck. The New York Central was able to provide such facilities along its rail line at Thirty-third Street. In order to give its patrons equal facilities the Pennsylvania, the Erie, the Lehigh Valley and the Baltimore & Ohio have developed inland rail terminals along Eleventh Avenue north of Twenty-third Street. That of the Pennsylvania occupies two city blocks and each of the others occupies one city block. Each has a freight house and team tracks. The cars serving them are hauled off the car floats via float bridges and tracks laid across the Marginal Way, and are handled within the yard and to and from the car floats by switch engines. The track layouts are necessarily cramped and more or less inefficient of operation.

These float-bridge terminals were all opened about thirty years ago. It is interesting to note that all were antedated by that of the West Shore Railroad, which was built between Thirty-fifth and Thirty-seventh Streets, adjacent to the New York Central's facilities. This terminal was merged with the Thirty-third Street yard when the New York Central obtained control of the West Shore.

The Lackawanna and the Central Railroad of New Jersey have inland terminals of a similar character in the Bronx, on the north side of the Harlem River near Third Avenue, the Lehigh Valley has a Bronx terminal farther north at 149th Street, and the Lackawanna has two in Brooklyn — one in the Wallabout district and one in South Brooklyn. The Bronx terminal of the Lackawanna is operated in the name of the Harlem Terminal Company, and the majority of the other New Jersey railroads have trackage rights in it.

YARD AND OTHER LOCAL RAIL FACILITIES

Originally, when the tonnages were small, the problem of handling them at the point of contact of land and water was relatively simple. Trains were short in those days, and a few switching tracks sufficed for distributing the cars to the unloading points. As the traffic grew in volume and complexity the waterfront yards grew laterally and longitudinally. In the course of time the New Jersey railroads spread over almost the entire waterfront of Jersey City and a large part of that of Hoboken and Weehawken, and ultimately it became necessary for some of them to separate the breaking up and making up of their long road trains from the more minute switching at the float bridges and lighterage piers by acquiring land some miles inland and building extensive "break-up" yards. The New York railroads also spread over considerable areas in Manhattan, the Bronx, Brooklyn and Queens.

Although the general manner of development of the yard and other rail facilities of all of the railroads has thus been substantially the same, circumstances have greatly varied the details.

Pennsylvania Railroad — While the Pennsylvania did not acquire its Jersey City terminal until 1871, that terminal as established by the New Jersey Railroad & Transportation Company was the first on the Hudson River waterfront. This fact is reflected in the Pennsylvania's location, directly opposite the most highly developed part of New York.

In the course of time, however, the Pennsylvania needed more room than that originally acquired by the New Jersey Railroad & Transportation Company. A second waterfront terminal was created, with a separate entrance from the Bergen Hill cut, and now the two developments, the so-called South Jersey City terminal on the south and the Harsimus Cove terminal on the north, occupy the entire waterfront from York Street to the Erie yards, a distance of nearly three-quarters of a mile, separated only by Jersey City's one public pier at Morgan Street. Back from the waterfront, two yards were developed — the Meadows yard east of the Passaic River and the Waverly yard in the southern part of Newark — and a freight cutoff was built connecting them. Still further expansion was provided for by means of a bridge across Newark Bay and a new gravity classification yard and waterfront terminal at Greenville. The Waverly-Greenville line was begun about 1890, but was not completed until 1904. By this time the Pennsylvania had acquired control of the Long Island Railroad, and a three-mile car ferry was established across the Upper Bay, from Greenville to Bay Ridge in South Brooklyn.

Except as it made it possible to reduce the Pennsylvania's operations at its passenger terminal in Jersey City and assign certain of the facilities to freight uses, the Pennsylvania's Hudson River tunnels and Thirty-third Street Station, opened in 1910, have no bearing upon the freight situation, inasmuch as the Pennsylvania's franchise covering the improvement is for passenger service. The still newer enterprise, the New York Connecting Railroad, of which the Pennsylvania is a part owner, will be discussed later.

At the present time the Pennsylvania uses the Jersey City and Harsimus Cove terminals for Manhattan and local New Jersey freight, and the greater part of its lightered business and the Greenville facilities for Brooklyn freight and Long Island and New England interchange. The Meadows yard serves the Jersey City and Harsimus Cove terminals, while the Greenville yard serves the terminal at that point. The Waverly yard is used mainly for the transfer of less-than-carload shipments. The Pennsylvania is understood to have plans under way for a large break-up yard east of Waverly yard.

At South Amboy is the company's principal coal terminal in the Port District, although there are coal trestles at both Greenville and Harsimus Cove.

Erie — The Erie obtained a passenger entrance to Jersey City ~~in 1852~~ by leasing the independent line from Suffern to a junction with the New Jersey Railroad & Transportation Company, whose terminal it used. Four years later the Long Dock Company was incorporated as a subsidiary of the Erie to build the Bergen tunnel and an independent terminal north of that of the New Jersey Railroad & Transportation Company. The new terminal for both passenger and freight traffic was opened for service in 1862 on the site of the Erie's present principal terminal, and has since been expanded to the Pennsylvania property on the south and that of the Lackawanna on the north — a frontage of about 2000 feet.

In 1881 ~~the Erie began~~ a second waterfront terminal at Weehawken, ~~about~~ two miles north of its Jersey City ~~terminal~~, through the incorporation of the New York, Lake Erie & Western Docks & Improvement Company. Connection was to be made with the Erie by means of a line skirting the base of the bluff, which is near the river ~~at Weehawken~~ and about a mile inland at Jersey City. A dispute over the right-of-way arose with the New Jersey Junction Railroad, which was being projected southward from the new West Shore terminal at Weehawken. In the end the Erie obtained and continues to have two tracks on the right-of-way of the New Jersey Junction Railroad.

The Weehawken terminal has a frontage of about half ~~a mile.~~ Being newer, and also being separated from the passenger traffic and local Jersey City facilities of the ~~Erie, the~~ Weehawken terminal has been better adapted to the establishing of lighterage piers, and has come to be the principal point for handling the lighterage business. There is also a float bridge there, but the bridges at Jersey City handle virtually all of the car-float traffic.

Through the leasing of the New York, Susquehanna & Western in 1899 the Erie acquired a third terminal at Edgewater. The Susquehanna & Western was built primarily to handle coal, and the Edgewater- (Undercliff) terminal is used almost exclusively for the Erie's coal business.

The Erie was one of the roads that found it desirable to go back to the Hackensack ~~Meadows~~ to locate its break-up yard. It has developed such a yard at Secaucus, known as ~~the~~ Croxton yard, from which short trains can be run by yard engines to either the Jersey City or the Weehawken terminal. The Susquehanna & Western had its own interior yard at Little Ferry when the Erie took it over, and this yard has been retained to ~~serve the Edgewater terminal, but~~ connected with Croxton yard to permit easy interchange of cars.

Lackawanna — The development of the Lackawanna's New Jersey facilities has been simpler than that of the foregoing roads because the Lackawanna handles its entire business at one waterfront terminal, supported by one principal interior yard. The development dates from 1863, when the Morris & Essex obtained its entrance to Hoboken. The terminal has expanded to a width of about a half mile, reaching from Newark Avenue, Hoboken, to the Erie yards in Jersey City. Its waterfront yards are sufficiently large to allow a considerable percentage of the road trains to be run direct to and from the waterfront; but mainly in the last twenty years a break-up yard has been developed on the Hackensack Meadows, near the Erie's Croxton yard. The main line of the Lackawanna divides just beyond the Bergen Hill tunnel. The north or Boonton branch, built shortly after the Lackawanna acquired the Morris & Essex, is operated as the main freight line, because of more favorable grades and less local passenger traffic. Consequently the break-up yard was located along this line and a wye connection is made with the south or Newark line.

Central of New Jersey — When the Central Railroad of New Jersey sought access to the Hudson River it obtained a grant of a large area of undeveloped land in Jersey City, mainly south of what is now the Morris Canal Basin. In subsequent litigation with the Lehigh Valley it was shut off from some of this land, but it retained a frontage of considerably more than a mile. Isolated from the rest of Jersey City by the canal basin, the Central of New Jersey has not been confronted with the problem ~~of the railroads~~ farther north, of expanding ~~its facilities~~ in the midst of built-up city streets. In consequence it has not yet reached the capacity of its original terminal grant, and has not been forced to go to the interior to develop adequate yards. Its main break-up yard is at the waterfront, together with its float-bridge, lighterage and other transshipment facilities.

Because of the arrangement of its lines to the south and west, however, in Bayonne, Elizabeth and Newark, and the large number of industries in those cities, it has in the course of time developed a number of auxiliary yards. The chief of these is at Elizabethport, from which point lines radiate in four directions. Here is the main transfer point for less-than-carload freight, and here are tracks for serving the industries at Elizabeth and south to Perth Amboy. A second yard, known as the Brills Yard, has grown up in

Newark to serve the Newark branch and its industrial sidings.

Extensive oil works have been developed on Constable Hook, Bayonne, and they depend upon the Central of New Jersey and the Lehigh Valley for direct railroad service. The East Jersey Railroad & Terminal Company, owned by one of the large oil companies, connects with the Central of New Jersey. On the south side of Bergen Point, also, is Port Johnson, which, until the completion of its modern car dumpers at Jersey City in 1918, had been the principal coal terminal of the railroad since soon after its crossing of Newark Bay. Mainly to serve this coal terminal and the oil road, a third auxiliary yard of the Central of New Jersey has grown up at Bayonne.

Interior of Railroad Pier Station, Outbound Section — Note Line of Trailers Waiting for Full Loads From Drays Along Tailboard Platform and Wide Space Necessary for Make-Up of Trailer Trains to Car Floats

Lehigh Valley — The first effort of the Lehigh Valley, we have seen, to gain its own entrance into the Port of New York was by canal. While the Morris Canal did not prove a satisfactory means of competing with railroads having their own tracks to New York, it did provide the railroad company with a site for a terminal on the Hudson River waterfront. The State of New Jersey had in 1867 leased the Morris Canal Basin to the canal company. When the Lehigh Valley in 1871 obtained control of the basin through the leasing of the canal, and also in the same year, by its purchase of the never-built New Jersey West Line Railroad, acquired a strip of land on the south side of the canal basin, it obtained practically the only New Jersey waterfront from Black Tom Island to Weehawken not by that time occupied by other railroads, with the exception of the steamship tract north of the Lackawanna terminal in Hoboken, which could not have been easily reached by rail even if obtainable. This merely gave the Lehigh Valley a foothold which it might later have been unable to acquire. As it was, the Central Railroad of New Jersey disputed its right to the property of the defunct West Line Railroad, and it was only after extensive litigation, lasting until 1887, that the Lehigh Valley established its title to the land. When it made its original deals for this land it had no rail line into any part of the Port District. In a few years it had the Easton & Amboy in service, but the extensions northward came slowly, and it was not until 1889 that connection was made with the terminal property and the terminal was opened for service.

While the Lehigh Valley thus had its terminal site in advance, and had a wide frontage on the Morris Canal Basin, the tract was too limited in width for adequate yard development, and the company has had to create a break-up yard west of Newark Bay, at Oak Island. It has also increased its waterfront facilities by the development of the Black Tom terminal of the National Docks Railway, of which it has had full control since 1900. The southern terminus of the National Docks Railway at Constable Hook gives the Lehigh Valley another terminal at that point, used mainly for special commodities, and the original terminal of the Easton & Amboy at Perth Amboy is retained as the company's principal coal terminal. A yard along the National Docks Railway at Claremont serves the Black Tom terminal, and one at Perth Amboy serves the facilities at that point. A spur on the north side of the Morris Canal Basin reaches various industries and a terminal of the Brooklyn Eastern District Terminal Company.

West Shore — How the West Shore Railroad, or its lessee, the New York Central, came into possession in 1885, shortly after the West Shore was completed, of the terminal site originally acquired by the promoters of the New York, Ontario & Western Railroad, has been related (page 104). It gave the West Shore a frontage of more than a mile, in Weehawken and West New York, with sufficient width east and west to develop a considerable yard behind the piers. In the course of time, however, still more yard space was needed, and a second yard was developed just west of Bergen Hill, at New Durham. In general the New Durham (Granton) yard is used for the breaking up and classification of inbound trains, and the Weehawken yard for the making up of outbound trains. as well as for direct service to the lighterage piers and car floats. Another small yard has been developed for storage purposes, at Bellmans, near Little Ferry.

Before the New York Central acquired the West Shore the West Shore established its principal Manhattan pier station at Franklin Street, Hudson River. This station was recently abandoned. Until then it and the original New York Central pier stations were used by both roads. The West Shore is operated purely as part of the New York Central, which is able to distribute the traffic on the two sides of the Hudson River to suit its convenience. For example, most of the New York Central export business is handled at Weekawken. Car-float operations between Weehawken and Sixtieth Street, Manhattan, afford direct exchange of cars within the Port District.

New York, Ontario & Western — When the New York, Ontario & Western in 1885 turned over the remainder of its Weehawken terminal to the West Shore, it retained a narrow strip with a frontage of 340 ft. at the north end, in West New York. On this strip it maintains two coal trestles, and it also has the use of some twelve tracks in the Weehawken yard for handling the coal cars. All of its other business is handled with the West Shore facilities.

Baltimore & Ohio — The history of the Baltimore & Ohio's facilities is not materially different from that of some of the other roads. It reached the Port of New York when the greater part of the New Jersey waterfront near lower Manhattan was occupied by other railroads, but gained access to the Upper Bay via Staten Island, utilizing the Staten Island Rapid Transit Railway. The waterfront terminal was established at St. George, the most northerly point on the island. There was not adequate space here for a break-up yard, but room was found farther west on the island, at Arlington.

The remainder of the Staten Island Rapid Transit Railway, from St. George south to Tottenville, is purely a local suburban railway, with little freight traffic, with the exception that a small part of it near St. George serves the American Dock Terminal and the Pouch Terminal, two private enterprises. In a short time, however, this section will be serving the twelve piers now under construction by the City of New York.

Philadelphia & Reading — The Port Reading Railroad received its charter in 1890 and was completed in 1892. The Port Reading terminal was created almost wholly for the handling of coal. The Reading's general freight is turned over to the Central of New Jersey at Bound Brook or at points farther west.

New York Central — Only the first terminals of what is now the Pennsylvania had been established within sight of Manhattan on the New Jersey frontier when the predecessors of the New York Central arrived on the scene. The first of these, the New York & Harlem, never played much of a part in the freight situation, having little freight traffic, and being located in what became a residential section that prevented the development of freight terminals. The Hudson River Railroad, however, chartered in 1844 and built shortly after, became a unique factor in the situation. It is the one railroad that was able to establish and maintain freight terminals in the heart of Manhattan, the road that because of that position forced free lighterage upon the other railroads — the system that compels the New Jersey railroads to perform an expensive terminal service free of charge, and that has brought about charges of discrimination against the New Jersey communities, and appeals to the Interstate Commerce Commission.

The route of the line in question, the West Side line, is as follows: Coming down the east bank of the Hudson, it crosses Spuyten Duyvil Creek at the upper end of Manhattan, where the passenger line turns eastward, and stays on the river bank to Sixtieth Street, except for a short distance where it passes through Fort Washington Park. At Sixtieth Street it swings east to Eleventh Avenue, which it occupies to Thirty-third Street, where it turns diagonally across to Tenth Avenue and Thirtieth Street. Thence it follows Tenth Avenue south to its junction with West Street and West Street to Canal, Canal to Hudson and Hudson to the terminal at Beach Street.

The history of the New York Central's West Side terminal development has already been briefly outlined. The line was originally built south to Chambers Street. It handled both passengers and freight, and here as in New Jersey the demand for freight facilities was at first less acute than for passenger facilities, so that it was not until 1864 that a freight terminal of any size was established in the downtown section. In that year the St. Johns Park Terminal, occupying two city blocks bounded by Hudson, Varick, Beach and Laight Streets, was opened for traffic. The march of New York's development northward beyond that point at the time is evidenced by the fact that the tracks and driveways were entirely housed in one large building. It can readily be imagined that this now antiquated plant was when opened considered the last word in freight terminals.

Meanwhile Thirty-third Street, where there was at that time supposedly ample room for expansion, was established as the principal freight and passenger terminal, while at Sixtieth Street there grew up a classification yard, lighterage piers, float bridges and other facilities. As the traffic grew the facilities at both Thirty-third Street and Sixtieth Street were expanded to the limit of their area. The company, we have seen, inaugurated marine service at an early date in the competition for East River traffic, and when the floating of cars was still in its infancy it was forced to open pier stations alongside the rail line to relieve that already overtaxed facility.

Thus the New York Central, despite its strategic advantage, is in much the same position as the New Jersey roads as far as the economical handling of freight is concerned. Much of its traffic is of necessity handled by water, and the rail operations are scarcely less costly than the water operations. The entire rail plant is obsolete and inadequate, and has been for years. No material improvement has been made for a generation, because none is possible without radical changes. The company has not even the opportunity seized by most of the New Jersey roads of receding a few miles and building modern break-up yards on the Jersey meadows. Consequently the New York Central retains its inadequate Sixtieth Street yard and does such preliminary classification as it can at West Albany or other division points some distance from New York. Within the last year or two, because of the crowded conditions at Sixtieth Street yard, the main less-than-carload transfer operations have been shifted to Yonkers.

Apart from the inadequacy of the West Side line from the business standpoint, the public has found it objectionable in a number of ways. This fact has given rise to litigation, discussion and legislation — all of which have to date brought no tangible results. The West Side problem is a much larger and more involved subject than the mere matter of the New York Central track service south of Sixtieth Street; but in the eyes of a large percentage of the public the New York Central, with its surface tracks and its smoke, is the West Side problem. The history and present status of the problem according to the popular conception are set forth in Chapter 8.

In 1843, about four years after the extension of the New York & Harlem to the City Hall, that company built a freight station at Center, Franklin, Elm and White Streets, the site of the present Criminal Courts Building. When the New York & New Haven some five years later became a tenant of the New York & Harlem it shared this terminal. Subsequently the Harlem developed Port Morris, the terminus of the Port Morris branch, as a freight terminal, and with the taking over of the Harlem road by the New York Central and the establishing of the Harlem line as the entrance for all New York Central and New Haven passenger trains, freight operations on the line at length ceased. The Port Morris terminal has been retained, and includes two piers, but handles only a small traffic.

The New York & Northern, predecessor of what is now the Putnam Division of the New York Central, at one time had a pier station at the foot of Pike Street, East River, and floated cars between it and its rail terminus at High Bridge on the Harlem River. The New York Central has retained a pier station at approximately the original East River site, but the floating service to the Putnam line was long since discontinued.

New Haven — If the New York & New Haven Railroad had sought and obtained its own entrance into New York, as did the Hudson River Railroad, which was built about the same time, it is possible that the New York, New Haven & Hartford would now have a rail line down the East Side to the heart of the business district, as the New York Central has down the West Side. Instead it relied upon trackage rights over the New York & Harlem from Williamsbridge. The Harlem itself was destined never to acquire a heavy freight traffic, never to become a great power in transportation. It may have been chance and not foresight that put the Hudson River Railroad where it could continue to operate freight trains as the city grew, but the Harlem, prohibited from the start from operating steam locomotives south of Fourteenth Street, soon found itself in the midst of a residential section. The steam locomotives were crowded back to Thirty-second Street and then to Forty-second, and above Forty-second Street the tracks had to be arched over. By the time the first Grand Central Station was completed and the New York Central had leased the Harlem, it was apparent that the line was not suited to freight operation. It was then a simple matter for the New York Central to make the West Side line the freight route and Park Avenue (Harlem) line the passenger route — leaving the New Haven freight traffic to shift for itself.

The New York & Harlem fought the crowding back of its steam locomotives. Perhaps the New Haven, with a line of its own, could have fought no better, but its growing freight traffic would have given it more incentive, and it would especially have had a better chance if it had originally found an independent entrance nearer the East River. However that may be, the New Haven, in spite of the obstacles to economical operation, maintained the terminal at Center and Franklin Streets, built by the New York & Harlem, until 1885. The block is about 180 x 200 ft., and the terminal had eight tracks, on which it is stated that it handled about 100 cars daily. The upper stories of the terminal were given over to factories.

At length it became necessary to abandon this terminal. In 1873, however, the Harlem River & Port Chester Railroad was opened from New Rochelle on the main line of the New Haven to the Harlem River east of the New York & Harlem. The line was taken over by the New Haven the same year, and by 1885, when the inland Franklin Street station was abandoned, the New Haven had two or three East River piers. Since then its Manhattan freight service has been a marine operation exactly as has that of the New Jersey roads, with the added disadvantage of a longer water haul and the perilous trip through Hell Gate — which has resulted in more powerful tugs and more rugged car floats for the New Haven line than the majority of the other roads possess.

Like most of the New Jersey roads, the New Haven first exhausted its available space at the Harlem River waterfront and then receded to a suitable location for a break-up yard, the location in this case being Oak Point, which is well within the city limits of New York. Within the last few years the New Haven has electrified its line to New Haven, and the Oak Point yard is operated by electric locomotives, being one of the few large freight yards in the country so operated.

Long Island — The Long Island Railroad is not a trunk line, but a group of short-haul and ~~strictly suburban lines~~ loosely woven together, and the Com~~mission has not sought to~~ trace through the development of their terminals in any detail. At present there are two principal inland terminals, two waterfront terminals, a main break-up yard and one other large yard. The heavy passenger traffic is divided between one of the inland terminals, one of the waterfront terminals and the Pennsylvania Station in Manhattan.

Long Island City was the original terminus of part of the system, and here has been developed the characteristic waterfront terminal, for both passenger and ~~freight traffic~~. Cars are floated from ~~here to Man~~hattan pier stations. The terminal is steam operated.

Flatbush Avenue, in the heart of Brooklyn, and not on the waterfront, is the other principal original terminus. Its growth has been the typical development of an inland stub terminal. There are both passenger and freight facilities, but limited opportunity for expansion. The line in the vicinity of the terminal is below ground and only electric operations is permitted.

Bushwick Terminal is a freight development about midway between the two foregoing terminals. It is inland, but is afforded a measure of water service through ~~being at the head of the English Kills, a trib~~utary of Newtown Creek.

The second waterfront terminal mentioned is that at Bay Ridge in South Brooklyn. The terminal has been developed since the Pennsylvania obtained control of the Long Island and established its own waterfront terminal at Greenville. Bay Ridge is the Long Island terminus of the car ferry to and from Greenville.

Most of the Long Island lines come together at Jamaica, and just east of Jamaica is Holban yard, the principal break-up yard. Holban yard does not serve the North Side division to Flushing, Whitestone and Port Washington, to serve which smaller yards have been developed in the Long Island City district. One of the yards in this district, Sunnyside yard, is largely a coach yard for the Pennsylvania passenger service.

Central Railroad of Vermont, and Southern Pacific Company — Two other trunk-line railroad companies give direct service to the Port of New York. The Southern Pacific Company does so through the Morgan Line of steamships, operated to and from the Gulf of Mexico — connecting with the railroad lines at New Orleans, but handled as an independent enterprise. The Central of Vermont gives a more direct railroad service, operating steamships to and from its railhead at New London as an integral part of its rail service.

SPECIAL FACILITIES

Special facilities have been developed by practically all of the roads to handle certain commodities, such as coal, grain and milk.

Coal — Coal has been a principal commodity of most of the roads from their earliest days. Until comparatively recently the coal was transferred from car to boat by some sort of elevated trestle, and there is still considerable use of trestles. A later development, however, is the car dumper; several of these have been installed within the last five years, and there are now eleven in the Port District.

With the development of car dumpers have come partial transfers of the coal-handling operations to other sites. For example, the Erie, which had a coal trestle at Weehawken before it acquired the Susquehanna & Western, still handles some coal there, but built its modern car dumper a few years ago at Edgewater on the Susquehanna & Western. The Central of New Jersey built its dumpers at Jersey City in 1917–18 and transferred its main coal operations from Port Johnson, Bayonne. The Pennsylvania and Lehigh Valley, on the other hand, while building certain trestles at the newer terminals farther north, have retained South Amboy and Perth Amboy as their principal coal terminals, and have erected modern car dumpers at those points. The Lackawanna, Baltimore & Ohio and Philadelphia & Reading have also erected car dumpers at their respective terminals — those of the Lackawanna being the oldest in the Port. The Ontario & Western has two coal trestles.

Grain — As compared with the railroads of some other ports, the Port of New York is very inadequately supplied with grain-handling facilities. The Erie has a fairly large but old grain elevator at Jersey City. It was built about 1880, and naturally lacks the most modern machinery. The New York Central has one nearly as old at Sixtieth Street, as has the West Shore at Weehawken. A second and larger one was built at Weehawken about fifteen years ago, but even this has not the capacity or up-to-date equipment of some of the newer elevators at other ports. The Lehigh Valley has two small elevators at Black Tom. The Lackawanna has a crude substitute for an elevator in a grain trestle. The Pennsylvania had an elevator at Jersey City, but it had fallen into disuse with the completion of the company's modern elevator at Philadelphia, and about two years ago it was torn down.

The majority of the coal and grain-handling facilities in the Port are designed for loading into barges or floating elevators rather than into ships. Thus they conform to the established practice of the Port — transference between car and ship through an intermediate lighterage service rather than direct.

Milk — Milk is one of the most important special commodities. Scores of carloads of milk are brought to the Port District every day, mainly in special milk trains. The type of facilities developed for handling the milk is simple, consisting of covered platforms with tracks on one side and driveways on the other. There is no floating of milk to the Manhattan pier or inland rail stations. All milk brought in by the New Jersey roads is unloaded at milk platforms on the New Jersey side, usually near the passenger terminals, and is thence trucked to its destination, that for New York coming via the ferries. The New York Central brings its milk down the West Side line, on which it has two stations, one at Thirtieth Street and one at 130th Street.

To describe the development of the numerous facilities for handling other special commodities would require a volume in itself. The Commission goes into the matter of coal, grain and milk more fully in other chapters of this report.

FERRIES

Not only milk but New Jersey produce and a considerable amount of other freight are moved across the Hudson and East Rivers and the Upper Bay by ferry. Like the other local marine service, the ferry system of New York Harbor is more highly developed than in any other port in the country.

From the time of their arrival on the New Jersey waterfront until scarcely a decade ago the New Jersey railroads depended absolutely on boat service of some form to get New York passengers to and from the trains. Barge service and later the car-float system were developed for the bulk of the freight transfer, but this did not obviate the necessity for passenger boats, nor the need for sufficient space on them for personal baggage, express business and other rapid goods transport. There came also to be a need for means of getting street vehicles across the Hudson, as well as the need for rapid transport of pedestrians and vehicles across the other unbridged waters of the harbor. Out of these combined necessities grew the modern double-ended ferry-boat, with cabins for passengers and clear roadways from end to end to permit trucks to drive on the vessel at one end and off at the other.

The earliest records of the Dock Department of the City of New York, in the early 70's, show that the Pennsylvania then had ferries from Cortlandt, Desbrosses and Twenty-third Streets, the Lackawanna from Barclay and Christopher Streets, the Erie from Chambers Street and the Central of New Jersey from Cedar Street. There was a non-railroad ferry to Staten Island from Dey Street, Hudson River. There were also ferries in the East River. Subsequently the Erie, Lackawanna and Central of New Jersey added ferries at Twenty-third Street, New York, the West Shore came upon the scene with a ferry at Forty-second Street and one at Franklin Street (now transferred to Cortlandt Street), the Lackawanna and West Shore each established an additional ferry to New Jersey points other than their railroad terminals, and the Pennsylvania opened a ferry to Brooklyn. The Staten Island ferry was moved to the extreme south end of Manhattan (South Ferry), which became a focal point for ferries.

With the opening of the Pennsylvania Station in Manhattan and the gradual discontinuance of service at the old Jersey City passenger station, the Pennsylvania dropped its Twenty-third Street and Brooklyn ferries. Vehicular and local pedestrian traffic has kept the other two Pennsylvania ferries busy, nor has the opening of the Hudson & Manhattan tubes, which give Erie and Lackawanna passengers an alternative route to and from New York, caused those roads to dispense with any of their ferries, which continue to handle a large volume of both passenger and vehicular traffic. (Within the last few months the Erie has suspended its Twenty-third Street service, but the Commission is not convinced that the change will be permanent.) The Central of New Jersey and West Shore are not reached by the Hudson & Manhattan tubes and still depend on their ferries.

Combined Waterfront and Break-Up Yard Equipped for Flat Switching by Electric Motors

Having no passenger terminals at the Port, the Lehigh Valley, Baltimore & Ohio, Ontario & Western and Philadelphia & Reading have no ferries. The Long Island has a ferry from Long Island City to East Thirty-fourth Street, Manhattan.

For a number of years the Pennsylvania and the New Haven maintained a ferry for through Boston-to-Washington passenger trains from Oak Point to Jersey City. Since the opening of Hell Gate Bridge these trains have used the Pennsylvania tunnels.

The character and capacities of the ferries, with other pertinent information as to their operation, is set forth in some detail in Chapter 19.

INTERCHANGE AND BELT LINES

At every railroad center there is a large exchange of cars. New York is no exception, but the interchange facilities are exceptional. Chicago, Buffalo and other large centers have their belt lines. The Port of New York is very inadequately equipped with belt lines, and a large part of the exchange of cars is by car float. The New Jersey roads (with the exception of the Baltimore & Ohio and the Philadelphia & Reading), are connected by a crude sort of belt line, made up of three links owned by as many of the New Jersey roads. The three railroads east of the Hudson have recently been connected through the medium chiefly of a belt line owned by two of them. The New York and New Jersey railroad groups, however, are separated absolutely, and a large part of the interchange is between the groups.

How extensive the interchange business was and how it was conducted before the advent of the car float the Commission has not attempted to ascertain. Since that time, however, a special type of car float has been developed for the interchange business, with the center platform replaced by a third track, increasing the capacity of the float about fifty per cent.

The New Jersey belt line, such as it is, was not built according to a definite program to connect all of the New Jersey roads. Its component parts were developed to serve quite diverse purposes, and it is more or less fortuitous that it was possible to join them up physically. The line is in the congested section east of Bergen Hill and the Palisades, and at one point a double switchback operation is involved. It is made up of the National Docks Railway, the New Jersey Junction Railroad, and the Erie Terminals Railroad.

National Docks Railway — It may seem a far cry from oil refineries to railroad belt lines. Yet it is out of the necessities of the refining and distribution of oil that the first section of the present New Jersey belt line came into being. The distribution and refining of oil was one of New York's important industries as early as the middle of the nineteenth century. The first refineries were grouped around the Newtown Creek section of Brooklyn. A large part of the business was handled by the Pennsylvania, through the Empire fast freight line, which had its first oil terminal at Elizabethport, on the line of the Central Railroad of New Jersey. To distribute this oil the Empire Line made a contract with the National Storage Company, of Brooklyn, which had been organized in 1867, as a general storage and lighterage company.

In a short time the company moved to the vicinity of Black Tom Island, on the New Jersey shore of the Upper Bay, and in 1876 it acquired a part of the island. It then had about 100 acres of land, and it had a contract with the Pennsylvania, with which its management was closely allied, not only to carry its oil to the Newtown Creek refineries, but to handle all of the Pennsylvania's lighterage and pier-station business. At the same time it had rail access to the Central of New Jersey only, and the desirability of a connection with the Pennsylvania was apparent. Consequently the Storage Company in 1879 organized the National Docks Railway, and in 1883 the first section of this line was opened, from Black Tom north to a connection with the Pennsylvania's main line in Jersey City. The Pennsylvania had meanwhile (in 1881) bought out the National Storage Company's lighterage and freight business, and thereafter the Pennsylvania conducted its own marine operations.

Until 1894 the National Storage Company owned all of the stock of the National Docks Railway, which had meanwhile been extended south to Constable Hook, Bayonne, now the principal oil district of the Port. Then the Lehigh Valley, which had recently completed its line to its Jersey City terminal property, acquired a half interest, which it increased in 1900 to entire control. The Pennsylvania had begun the Waverly-Greenville line, and with its direct line across Newark Bay to the projected terminal at Greenville its need for the indirect National Docks connection disappeared.

The Lehigh Valley was then directly linked with the Central of New Jersey and the Pennsylvania, but not with the roads above the latter. The New Jersey Junction Railroad had been built south from the West Shore to the Pennsylvania. After several years of litigation the Lehigh Valley effected a crossing of the Pennsylvania and a connection with the New Jersey Junction. The connecting link was called the National Docks & New Jersey Connecting Railway.

New Jersey Junction Railroad — In 1861, six years before the organization of the National Storage Company, the New York & Bulls Ferry Railroad was incorporated. The following year it was reincorporated as the New York & Fort Lee Railroad, but it was not opened until 1870. It then ran from a connection with the Erie in Hoboken or Jersey City to a point in the present Weehawken yard of the West Shore Railroad, a distance of about 2½ miles. It crossed the Lackawanna, but there is no indication that it was intended as a belt-line railroad.

When the West Shore was built in the 80's the tracks of the New York & Fort Lee Railroad became enveloped in the Weehawken yard, and the line was leased to the New Jersey Junction Railroad, which the New York Central, the new owner of the West Shore, organized in 1886 to effect a connection with the roads to the south. By the merging of other lines the New Jersey Junction reached the Lackawanna, the Erie and the Pennsylvania, and then the Lehigh Valley brought itself and the Central of New Jersey into the system with its National Docks & New Jersey Connecting Railway.

In 1910 the New York Central built the New Jersey Shore Line north to the Hudson-Bergen county line, where it connected with the Edgewater & Fort Lee Railroad, an Erie project. The main purpose of both of these lines was to afford access to the numerous industries springing up along the foot of the Palisades. The New Jersey Shore Line was merged with the New Jersey Junction Railroad in 1913.

Erie Terminals Railroad — In 1901 the Edgewater & Fort Lee Railroad was incorporated to build a railroad from the Hudson-Bergen county line to Fort Lee, opposite 160th Street, New York — the other section of the railroad project at the base of the Palisades. The line was completed about 1907 to Edgewater, opposite 130th Street. En route it encountered the Edgewater yard of the New York, Susquehanna & Western Railroad. This yard lies approximately at right angles to the Hudson and occupies all of the limited space between the river and the cliff forming the Palisades. The only way found to get the new line past this yard without destroying the yard was to build a double switchback, one leg running out on a pier and the other into the tunnel under the Palisades.

This line was reincorporated in 1907 as the Erie Terminals Company. It is owned entirely by the Erie and the Susquehanna & Western.

This improvised belt line from Constable Hook to Edgewater is double-tracked and fairly effective as far north as Weehawken, although its ownership divided between two of the six railroads it connects puts the remaining four at a disadvantage. North of Weehawken it is only single-track, and that fact and the double switchback reduce its capacity to the bare requirements of the important industries along it.

Hoboken Shore Road — One other New Jersey marginal railroad which plays an important role, but not as a tie between railroads, is the Hoboken Shore Road. It was opened in 1898 as a separate enterprise. It runs south from a junction with the New Jersey Junction and the Erie at the latter's terminal to within a short distance of the Hoboken terminal of the Lackawanna, about 1½ miles, serving the piers formerly used by the Holland-America, North German Lloyd and Hamburg-American steamship lines. It has a float bridge in Weehawken Cove for the interchange of cars with the Baltimore & Ohio at St. George. Interchange with the other New Jersey roads is had via the belt-line system.

When the United States Government took over the piers this railroad served, it bought the railroad outright. Now the Government owns and operates the road, with a group of army officers for directors, and civilian operators. It handles both Government and private freight.

New York Connecting Railroad.— Hell Gate Bridge and the New York Connecting Railroad constitute the newest large railroad enterprise in the Port of New York, and link up the railroads east of the Hudson. They were put into service in 1917. The New York Connecting Railroad, owned jointly by the Pennsylvania and the New York, New Haven & Hartford, starts at a connection with the Harlem River branch of the New Haven at Port Morris, runs south across the Bronx Kills and the Little Hell Gate branch of the East River to Wards Island, then turns east across the Hell Gate branch to Long Island. Here it forks, one branch, for passenger service, running to Sunnyside yard and the tunnel to Manhattan, the other continuing south to a junction with the Bay Ridge line of the Long Island Railroad near East New York.

The line completes the direct connection between the Pennsylvania and the New Haven, only the short car ferry between Greenville and Bay Ridge breaking the rail circuit. Direct connection is made with the Long Island, and the New York Central also gets access to the system via its Port Morris branch.

LOCAL NEW JERSEY AND OUTLYING NEW YORK FACILITIES

From the foregoing it is seen that while a large percentage of the railroad facilities of the Port are in New Jersey, they have been developed with the prime necessity of serving New York. This was quite natural, inasmuch as the railroads preceded most of the New Jersey population. In 1832, for example, when the forerunner of the Pennsylvania built southwest from the Hudson, Jersey City had less than 3,000 inhabitants and Newark less than 15,000, while New York City had more than 200,000. In 1863, when the Lackawanna arrived at Hoboken, Hoboken had barely 10,000 inhabitants. In 1871, when the Lehigh Valley, the latest arrival in Jersey City, obtained its terminal site, that city still had a population less than 100,000 and the total population of Hudson and Essex Counties was less than 300,000, while New York City had nearly a million and Brooklyn half as many. It is hardly to be wondered at that the railroad companies concentrated their attention on New York.

In the course of time the growing New Jersey communities claimed the attention of the railroads, and local freight houses and other facilities more commensurate with the needs were created. But by this time the available areas in the waterfront cities were mostly taken up, and the whole scheme of railroad operation had been developed on a different basis. In consequence, although almost every waterfront terminal and every inland community has its local freight house and team tracks, the New Jersey cities find it expedient if not necessary to receive and deliver much of their freight via New York — through the medium of the truck and the ferry. Jersey City, though largely railroad yards, depends largely on New York for railroad despatch; and even Newark goes to New York for much of its food.

Because of the large mileage of its various lines within the city of New York, the New York Central has an advantage over the other New Jersey roads in its ability to serve local districts of the city. At 130th Street, for example, it has a milk station and other facilities, and it has a virtual monopoly in that district. It also has numerous other small freight stations in upper Manhattan and the Bronx. The New Haven and the Long Island also have numerous small stations in their territory within the city.

Conclusion

It is apparent from the foregoing, as already stated, that the development of New York's railroads, and especially that of their terminals within the Port, has been mainly a process of meeting the immediate necessity. Of precedent there was none. Of data for a forecast of the growth of traffic, very little. Yesterday, so to speak, there were no railroads, but there was a growing community waiting for them. Today we have railroads with hundreds of miles of tracks, scores of freight stations, scores of lighters and car floats and tugboats — but the community has grown so fast that the railroads are as far behind the demands upon them as ever.

And yet, new as every part of the railroads is, the terminal system is old, so rapid has been the pace. In fact, some forty years ago the managers seemingly gave up the hopeless quest for a better system, and bent themselves to providing more and more of the type of facilities then existing. And so there has been no material change in the system for forty years.

Now the time has come when there must be a change, probably a radical change. The railroads have played their part, a most important part, in bringing commerce to the Port. So well have they played this part that the flow of commerce bids fair to overwhelm them unless a new way is found to take care of it. To find that new way has been one of the duties of the Commission, and the Commission is confident that it has found the way.

CHAPTER 6

Present Railroad Facilities, Methods, Tonnages and Costs

I—GENERAL

Two great transportation agencies — the railroad train and the ship — handle most of the freight that enters or leaves the Port of New York. Of these two the train alone, in 1914, handled 76,052,000 tons, including 12,937,000 tons carried through the Port by rail. If all of this freight had been loaded simultaneously into cars it would have filled a track on each of eight trunk lines across the continent, including the Canadian Pacific on the north and the Southern Pacific on the south.

It has been the Commission's aim to analyze this vast traffic from every angle before attempting to propose changes in the methods of handling it. An examination has been made of the facilities of each of the twelve trunk-line railroads within the Port for handling every kind of traffic found here. Full-day "clockings" have been made at all principal yards and terminals within the Port District to ascertain exactly what operations are performed. Statistics have been collected from the railroads to determine the traffic for an entire typical year, subdivided by railroads, by points of origin or destination within the Port, by methods of distribution or collection and by principal commodities. There have been built up from the records of the carriers unit costs of the characteristic operations for the same year. Figures of tonnages handled at Manhattan stations have been assembled for a period of fifteen years to show the average rate of growth of traffic. A study has been made of unit prices for materials and labor in different years to show the trend of operating costs. The United States Railroad Administration, which was in charge of the railroads during most of the period of this investigation, courteously gave the Commission access to whatever railroad records it desired, and the officials and employees of the railroads accorded the Commission's forces full co-operation. As a result the Commission is confident that it has developed a more complete and accurate picture of present railroad facilities, methods, tonnages and costs for the Port of New York than has ever been obtained before.

Typical Break-Up Yard on Hackensack Meadows — Engine Classifying Cars Over Inbound Hump

II—HOW THE INFORMATION WAS OBTAINED

The developing of the railroad picture can be divided into four general headings: (1) Examination of the available facilities of the different railroads, and the general methods of operation; (2) clockings at all principal yards and terminals to ascertain more exactly how they function; (3) tonnage studies with all their ramifications to determine total quantities, methods of handling, commodities handled and rates or increase; and (4) cost analyses. Supplementing the third and fourth are various special statistical studies.

Examination of Facilities

The examination of existing facilities was the simplest phase of the investigation. The Commission's forces of course had much knowledge on this score at the start, but plans were obtained from the carriers to amplify this information.

These plans are in the Commission's files, as are descriptions made by the Commission's forces of the facilities they cover, showing in detail the number, capacity and purposes of tracks, sizes of terminal buildings, sizes and character of piers and slips, and similar data.

"Clockings"

Combination of the foregoing maps and descriptions and the book records of traffic handled would not have been sufficient to show just how the plants function, where their elements of strength and weakness lie, what lessons could be gained for use in building up any new plan. To fill this need, each yard was "clocked"

Awning Sheds on Marginal Way at Typical Railroad Pier Station, Hudson River, Manhattan — Used to Expedite Movement of Food Products

for a period of twenty-four hours and each freight station for a working day, usually eleven hours. In other words, observations were taken at each key point with a sufficient number of men to record all movements of trains, cars, car floats and trucks, the commodities handled, their origins and destinations and other pertinent information.

The organization assembled to make these observations was described in the Commission's progress report of April 8, 1919. Under the guidance of the terminal engineer and his assistant some twenty-eight men were assigned to this task, twenty-four of them to work ordinarily in squads of eight men each, one man to proceed in advance of the observations and determine how many men to use and how to station them, one to check over the daily observations, supply omissions and correct discrepancies, and two to tabulate the data in the office.

The entire clocking organization was kept flexible, and the men were shifted as the occasion demanded. At times it was possible to divide the main force into two groups and cover two of the smaller terminals at one time — the idea of covering every point on every railroad at once and getting a simultaneous picture of the entire port not being feasible because of the very large force it would have required. At other times, at very busy terminals, it was necessary to press the office men into service and use the entire clocking organization.

In general the 24-hour observations at the yards were made with the three squads working on 8-hour shifts; while at the pier stations the 11-hour observations, running from 7 A. M. to 6 P. M., and covering the working day at the pier, were taken care of in two shifts of twelve men or less.

Character of Information Recorded

Following are samples of the character of information recorded:

For incoming and outgoing trains at break-up yards —

Origin of train
Destination of train
Engine number
Conductor's name
Train number
Time of arrival and departure
Car initials and numbers
Character of lading in each car
Weight of lading
Destination of each car

For cars forwarded over float bridges at waterfront yards —

Float number
Time float is placed
Initials and numbers of cars
Character of car lading
Weight of lading
Time cars are placed on float
Time float departs
Consignee's address
Origin of car

For lighters receiving freight from cars —

Kind of boat, number and name
Character and weight of lading
Initials and numbers of cars from which freight is transferred
Destination of boat
Time boat is placed
Time transshipment begins
Time transshipment is completed
Time boat departs

For trucks delivering freight at pier stations —

Owner's name or license number
Time truck arrives in line
Time truck reaches unloading platform
Time unloading begins
Time unloading is completed
Time truck departs
Character and weight of lading
Shipper's address
Destination of freight

These individual operations were covered by records of the following general character:

Break-Up Yards — Train arrivals and departures; classification of cars, either over "humps" or by "flat switching"; handling of cars at transfer platforms; trucking at transfer platforms; icing operations; interchange with other railroads.

Waterfront Yards — Train arrivals and departures; switching operations; transfer of cars to and from car floats; transshipments at lighterage piers between cars, piers, lighters and ships; movement of lighters and ships; trucking movements at piers; freight-house operations; team-track operations; milk-station operations; poultry-yard operations; grain-elevator operations; operations at coal piers, trestles and car dumpers, with and without storage facilities; operations at private sidings.

Pier Stations—Car-float, car and truck operations.

Inland Rail Stations—Freight-house and team-track operations.

During each clocking records were made of the number of men employed in each operation, and their rates of pay.

How the Field Data Were Obtained

One railroad, which may be designated as Road A, will illustrate in a general way how it was necessary to station these men to get the desired information in the field.

Break-Up Yard—At the break-up yard the clocking ran from 3 P. M. one day to 3 P. M. the next day, the three shifts being equal in length. Each shift used eight men, distributed as follows: One in the yardmaster's office to copy train lists; one at each end of the yard to count all trains, locomotives and cars entering and leaving and check the man in the yardmaster's office; one at each of the two classification humps; one at the transfer platform; one at the icing platform, and the eighth, the squad leader, to supervise the work and assist at any point where he was needed.

Waterfront Yard—At the waterfront yard the duration of the observation period was the same, as was the number of men utilized. In each shift one man was stationed on the main classification engine to record the movement of cars from the yard to the float-bridge and pier tracks, one was stationed in the yardmaster's office, one at the float bridges, four were placed at the lighterage piers and the squad leader was left free as before to supervise the entire count.

Pier Stations—The same men were used in the count at the carrier's principal Hudson River pier station, but in squads of twelve each, working in two shifts to cover the 11-hour day.

Five men were assigned to the cars and floats; three to trucking at the outbound bulkhead shed platform to get information on the trucks received; three were stationed at the entrance gates of the piers to get data concerning trucks forwarded, and the twelfth supervised the entire investigation. This was the assignment in the morning, but in the afternoon three of the men were taken from the cars and floats and directed to help with the trucking observations.

At other pier stations squads of six men each were assigned to make the counts, two stations being covered simultaneously.

To facilitate the rapid recording of the observations in the noise and confusion of the yards, by night as well as by day, numerous forms were devised.

The first clocking was begun July 23, 1918. The last railroad clocking, exclusive of certain special observations made later for particular purposes, was completed January 18, 1919. In that interval, during which there were 148 working days, 129 separate clockings were made. After the railroad clockings were completed, observations of a similar character were made covering the unloading and loading of several steamships of different types.

Purpose of the Clockings

Calculations based on one day's observations would be unsafe, because of the wide fluctuations of traffic from day to day and from season to season. To determine what traffic any new facilities proposed would have to accommodate the carriers' records for an entire year were drawn off. The clockings were necessary to give an accurate picture of actual conditions at the terminal points, show the time ordinarily required for various operations, reveal restricting points and weaknesses in yard design that should be avoided in any new plans, and furnish much other invaluable information. The observations were made to guide the Commission's engineers in their studies, and the figures, which would be misleading without extensive interpretation, are not offered as part of this report. Readers of the report will be better guided by the tonnage and cost figures derived from the records of the carriers.

Tonnage Studies

The tonnage studies and the cost analyses were both made under the direction of the chief statistician by a force of about fifteen statisticians and accountants. While a number of other tonnage studies were made to solve particular problems of the Commission, the following are considered the most important:

Subdivision of the total railroad tonnage for one full year (1914) by direction of flow, by railroads, by geographical divisions, by methods of distribution, by principal commodities.

Detail study of Manhattan station operations, including car movements, and also including study of increases for fifteen years, 1905–1919 inclusive.

Detail analysis of operations, including loaded and empty car movements, and embracing every element of the terminal service for one month (July, 1914) as a basis for the cost analyses.

Detail analysis of operations for the one-day periods covered by the clockings.

Sampling Methods

Five years would probably be required to get all of the railroad data alone that the Commission could have used in these studies. The data would cover in detail a period of years. While such an extended record was desirable, it was not indispensable for a reliable picture of the present and forecast of the future. The result sought has been accomplished, the Commission confidently believes, by a judicious sampling method, in which such samples and enough of them were taken as would eliminate the distorting effects of deviations from average conditions. In the case of the commodity classification no single month, because of seasonal fluctuations, would have told the story correctly, and it was necessary to select days throughout the year in such a way as to strike a representative average.

The total annual tonnages, however, are actual, as are the amounts by railroads and by geographical distribution for the year 1914. It was deemed necessary to have actual figures as a basis for determining the capacity required in any new terminal system. Fortunately this was a less difficult undertaking than some of the studies based on samples.

Field and Office Work

Preparation of the statistical data involved the two tasks, both laborious, of visiting the offices of the carriers and drawing off figures from a variety of records, and of dissecting and reassembling those figures in the offices of the Commission. A large number of records had to be examined, few of which were in the form for direct use in the investigation.

Before the work of drawing off the carriers' records was undertaken, surveys were made by an experienced man of the sources of information, the information available and the procedure to be followed with respect to each railroad. From the surveys a plan of action was worked out for each study, so that the field parties would know exactly the tasks before them, step by step.

It was not feasible for the field force to get all the data required in one visit to a carrier's offices, or even in one visit to a department of the carrier. The separate studies had to be made independently, and the field men had to make repeated visits to the carrier with specific programs in hand. Much of the assembling and analysis, too, had to be made in the carrier's offices, with the original records.

The men worked in squads of two or three, with a supervisor for all of the squads. In general ten or twelve men were available for the field work.

Collecting the Tonnage Data

There were three distinct phases to the field work of collecting the tonnage data. The statement of total tonnages and cars for the entire year received and despatched at stations was built up from daily records of the agents at each station. The subdivision of these tonnages by commodities required close examination of other records of the same agents. The statement of traffic passing through each terminal operation during one month, used in the cost analysis, was obtained from the local records at each key point in the operation — yard, float bridge, car float and terminal station.

Total Tonnage Statements — Except for its sheer volume, due to the necessity of visiting some fifty odd stations and recording at each point the inbound and outbound movement, for each of 300 working days, the collection of the total tonnage and car-movement figures was simple, and the figures required no analysis or interpretation.

Tonnages in Each Yard Operation — Recording the traffic at each key point for the month of July, 1914, to make possible the separation of costs by major terminal operations, was more difficult. Starting with the break-up yard, and considering inbound freight first, it was necessary to examine and tabulate what are known as the conductors' wheel reports, which list individual car initials, numbers, contents and weights — a report for each and every train.

Wheel reports do not account for the train after it enters the yard. From this point to the waterfront yard the movement was as a rule covered by conductors' train lists — sheets giving the car initials, numbers, contents and usually destinations, but no weights. In order to ascertain the weights it was necessary to perform the difficult operation of matching the cars with the conductors' wheel reports.

Receipt of the cars at the waterfront yard was usually evidenced by local records maintained there by the yardmaster. His records also as a rule showed the distribution of the cars through the yards, including the movements out over the float bridges.

The movements over the float bridges were verified by records maintained by the floatmaster. Here again it was necessary to follow the movement of the individual cars, inasmuch as some of them were destined to Hudson River stations, while others were destined to the East River, Brooklyn or other parts of the Port.

The final evidence of the movement of the inbound freight was found in the records of the agents at the local stations. These had to check the car-float records to the same stations.

At each point both the inbound and outbound records were drawn off, and the outbound records followed in reverse order revealed the picture of the outbound movement.

Throughout the study it was necessary to check the figures by independent records. For example, the recorded number of inbound cars received at the waterfront yard must agree with the number despatched for that yard from the break-up yard. If it did not the difference must be accounted for, whether it meant that certain cars had been dropped en route at local sidings, or that additional cars had been picked up. At each stage of the operation cars were turned aside from the current to or from the Hudson River stations, and other cars entered the current.

Commodity Classification — The field work of the commodity classification was far more laborious and difficult than that of either of the other main traffic studies. Thirty-nine days distributed throughout the year in such a manner as neither to ignore nor to exaggerate seasonal fluctuations were selected as sample days. The commodity schedule comprised twenty-six commodity groups. To determine the commodity of a shipment it was necessary to go to the individual way bill or the shipping ticket in the office of the local agent. The study therefore required visiting all of the local station agents and consulting the detail records for each of the thirty-nine days.

Cost Analyses

The principal cost study based on existing railroad facilities and methods was an analysis of the cost of each step in all terminal operations during July, 1914, on several of the railroads of the Port. Originally it was the intention to make basic the analyses of costs during the periods covered by the clockings, but it was concluded that the periods were too short and the conditions too abnormal, hence this study was not carried out as fully as the 1914 study.

A second important cost study was an examination of comparative prices for material and labor in 1914 and 1918 and the derivation of factors applicable to the 1914 figures to bring them to a 1918 basis. Numerous studies of lesser importance were made to aid in the detail analysis of the Port problem, and the various contemplated solutions of the Manhattan freight problem were tested out as to unit operating costs in the same manner as operating costs of existing facilities were tested.

Collecting the Cost Data

The same general difficulties were encountered in the cost as in the tonnage studies — the need for judicious selection of records to obtain reliable figures in the time available, and the necessity for visits to a variety of carriers' data not in a form usable directly by the Commission. And while the tonnage studies covered a greater volume of records, the cost studies were more complex in that every figure drawn off required analysis. The tonnage figures here reported are sums of figures drawn direct from one record or another. The unit cost figures are derived from cost totals which are summations of portions of individual cost items, the apportioning being based upon judgment, supported by precedent, as to the share freight operations within the terminal district should bear of items that might cover both passenger and freight operations for a hundred miles beyond the terminal district. The study required first ascertaining just what each item covered, and then applying to it a formula to eliminate that part not properly chargeable to the terminal operations under analysis.

Tractor-Trailer Operation — Fully Loaded Trailers Handling Outbound Freight at Railroad Pier Station

Such of the railroads of the Port, of which the New York Central, the central figure in the West Side problem, was necessarily one, were selected for the cost studies as would represent every type of operating condition. It was felt that by taking into account the volume of traffic, measured by both cars and tons, handled by each of the roads; the similarity or dissimilarity of operating methods used; the type and capacity of facilities available for handling the business, and the effort exerted in performing each operation, a composite of unit costs could be built up which would be representative of all of the railroads entering into the port problem.

Accountants first visited the offices of the auditors of disbursements of the railroads selected. From the general accounts and general disbursements balance sheets, with their supporting data, the accounts with the operating divisions comprising the terminal district were located and analyzed.

The disbursements were carried under 196 primary accounts prescribed by the Interstate Commerce Commission, coming under the six general subdivisions of maintenance of way and structures, maintenance of equipment, traffic, transportation, miscellaneous operations and general. A railroad disbursement is evidenced by a payroll charge, a report of the disbursement of material and supplies or a voucher payment. To run down payroll charges it was necessary in many instances to go to the individual time tickets. Similar steps were necessary in the case of voucher payments, and the study led to all of the departmental offices, of the operating, transportation, mechanical and engineering departments. The original records were in many instances only rough memoranda.

In general it was necessary to consider only the accounts of the operating divisions embracing the New York terminals. In the case of one railroad, however, there was no separation between operating divisions, and the accounts of the entire road had to be examined.

Another phase of the field work in connection with the cost studies was the determination of the fixed charges, such as depreciation, rentals, taxes and interest on investment. To determine the latter two items it was necessary to consult not only the carriers' records but also the tax departments of the two States and those of the local communities and build up parcel by parcel and item by item valuations and tax statements covering the facilities used in the terminal operations.

Allocating Cost Items to Terminal Operations

No simple rule can be devised for dividing on a fair basis items chargeable to all operations on a railroad division. The relative responsibility of passenger traffic and freight traffic for wear and tear on railroad roadbed, for example, is a moot question, on which there is no general agreement.

In 1917 one of the principal trunk-line systems conducted a study of terminal operating costs, in connection with which the views of the main accounting offices in the territory were canvassed. As a result of this canvass a committee of accountants developed a formula which the Commission believed was applicable

Formula Employed in the Preparation of Cost Data and the Assignment of Expenses to Yards, Terminals and Other Operations

Accounts	Bases for apportioning operating and other expenses to yards and terminals	Bases for apportioning operating expenses between freight and passenger service
Maintenance of Way and Structures 201. Superintendence	Apportioned on basis of payroll charges to all M. of W. accounts except 217; being the ratio that the aggregate of charges to this account bears to the total payroll charges to the above accounts	Assigned direct wherever possible, otherwise apportioned on basis of usage, that is, yard-engine mileage, engines handled, train mileage, trains handled, and so forth
*202. Roadway maintenance 204. Underground power tubes 206. Tunnels and subways 208. Bridges, trestles and culverts 210. Elevated structures	Assigned direct wherever possible; items common to two or more yards apportioned on the basis of the assigned charges	
212. Ties 214. Rails 216. Other track material 218. Ballast	Assigned direct wherever possible; items common to two or more yards apportioned on basis of charges to Account 220	
220. Track laying and surfacing 221. Right-of-way fences 223. Snow and sand fences and snowsheds 225. Crossings and signs 227. Station and office buildings 229. Roadway buildings 231. Water stations 233. Fuel stations 235. Shops and enginehouses	Assigned direct wherever possible; items common to two or more yards apportioned on basis of the assigned charges	
237. Grain elevators 239. Storage warehouses 241. Wharves and docks 243. Coal and ore wharves	Assigned direct wherever possible, balance apportioned on basis of the assigned charges	Assigned to freight
245. Gas producing plants		Apportioned on basis of service performed or output
217. Telegraph and telephone lines	Apportioned on basis of assigned charges to Accounts 201, 301, 351, 371, 372, 377, 407 and 452; being the ratio that the aggregate of charges to this account bears to the total charges to the above accoounts	Assigned direct wherever possible; balance apportioned on basis of usage
219. Signals and interlockers	Assigned direct wherever possible; balance apportioned on basis of the assigned charges	
251. Power plant dams, canals and pipe lines 253. Power plant buildings 255. Power substation buildings 257. Power transmission systems 259. Power distribution systems 261. Power line poles and fixtures 263. Underground conduits	Assigned direct wherever possible, balance apportioned on basis of the assigned charges	Apportioned on basis of service performed or output
265. Miscellaneous structures		Apportioned on basis of usage
267. Paving		Apportioned on basis of location
269. Roadway machines	Apportioned on basis of charges to Account 202; being the ratio that the aggregate of charges to this account bears to the total charges to Account 202	Assigned direct
*271. Small tools and supplies	Apportioned on basis of payroll charges to all M. of W. accounts except 201; being the ratio that the aggregate of charges to this account bears to above accounts	
272. Removing snow, ice and sand 273. Assessments for public improvements	Assigned direct wherever possible; balance apportioned on basis of the assigned charges	Assigned direct wherever possible; balance apportioned on basis of yard-engine mileage
274. Injuries to persons	Apportioned on basis of payroll charges to all M. of W. accounts except 201; being the ratio that the aggregate of charges to this account bears to the total payroll charges of the above accounts	Apportioned on basis of the assignment between freight and passenger service of payroll charges to all M. of W. accounts except 201
275. Insurance	Assigned direct	Assigned direct wherever possible; balance apportioned on basis of usage
276. Stationery and printing 277. Other expenses	Apportioned on basis of assigned charges to Account 201; being the ratio that the aggregate of charges to these accounts bears to the total charges to Account 201	Apportioned on same basis as Account 201
278. Maintaining joint tracks, yards and other facilities — Dr. 279. Maintaining joint tracks, yards and other facilities — Cr.	Assigned direct wherever possible, otherwise apportioned on basis of usage	Apportioned on same basis used in apportioning charges to yards and terminals
Maintenance of Equipment 301. Superintendence *302. Shop machinery	Apportioned on basis of payroll charges to all M. of E. accounts; being the ratio that the aggregate of charges to these accounts bears to the total payroll charges to M. of E. accounts	Assigned direct wherever possible, otherwise apportioned on basis of usage
304. Power plant machinery 306. Power substation apparatus	Assigned direct wherever possible; otherwise apportioned on basis of the assigned charges	Apportioned on basis of service performed or output
*308. Steam locomotives — Repairs †309. Steam locomotives — Depreciation †310. Steam locomotives — Retirements 311. Other locomotives — Repairs †312. Other locomotives — Depreciation †313. Other locomotives — Retirements	Average cost of repairs determined per locomotive-mile for all locomotives in yard service during the test month, based on repairs and mileage made by such locomotives during the 12-month period ended with the test month; apportioned to yards by multiplying this average rate by the yard locomotives mileage made in each yard during the test month	Apportioned on basis of yard locomotive mileage

* Missing numbers between Accounts 202 and 271 and between Accounts 302 and 308 indicate depreciation accounts for items immediately preceding, and were not considered. † Depreciation charges included with interest on investment; retirements not considered.

to a large extent to the New York problem. In the Texas freight rate case, also, a formula was worked out by a committee of railway accountants, and part of this, which resembles the other formula in many respects, was also thought applicable to this port. The Commission adopted many of the precedents estab-

Formula Employed in the Preparation of Cost Data and the Assignment of Expenses to Yards, Terminals and Other Operations — *Continued*

Accounts	Bases for apportioning operating and other expenses to yards and terminals	Bases for apportioning operating expenses between freight and passenger service
Maintenance of Equipment — continued		
314. Freight train cars — Repairs †315. Freight train cars — Depreciation †316. Freight train cars — Retirements 317. Passenger train cars — Repairs †318. Passenger train cars — Depreciation †319. Passenger train cars — Retirements 320. Motor equipment of cars — Repairs †321. Motor equipment of cars — Depreciation †322. Motor equipment of cars — Retirements	No charge to be made	No charge to be made
323. Floating equipment — Repairs‡ †324. Floating equipment — Depreciation‡ †325. Floating equipment — Retirements‡		
326. Work equipment — Repairs †327. Work equipment — Depreciation †328. Work equipment — Retirements †329. Miscellaneous equipment — Repairs †330. Miscellaneous equipment — Depreciation †331. Miscellaneous equipment — Retirements	No charge to be made	No charge to be made
332. Injuries to persons	Apportioned on basis of payroll charges to all M. of E. accounts, being the ratio that the aggregate of charges to this account bears to the total payroll charges to all M. of E. accounts	Apportioned on basis of the assignment between freight and passenger service of payroll charges to all M. of E. accounts except 301
333. Insurance	Insurance on locomotives only to be computed, apportioned on basis of ledger value of equipment assigned to yards and terminals	Apportioned on basis of yard locomotive mileage
334. Stationery and printing 335. Other expenses	Apportioned on basis of assigned charges to Account 301; being the ratio that the aggregate of charges to these accounts bears to the total charges to Account 301	Apportioned on same basis as Account 301
336. Maintaining joint equipment at terminals — Dr. 337. Maintaining joint equipment at terminals — Cr.	Assigned direct wherever possible, otherwise apportioned on basis of yard locomotive mileage	Apportioned on same basis used in apportioning charges to yards and terminals
Traffic		
351. Superintendence 352. Outside agencies 353. Advertising 354. Traffic associations 355. Fast freight lines 356. Industrial and immigration bureaus 357. Insurance 358. Stationery and printing 359. Other expenses	Apportioned on basis of total assigned operating expenses, except general office expenses, including outside operations; being the ratio that the aggregate of charges to traffic expenses bears to the total of all other operating expenses (except general office expenses) including outside operations	Apportioned on basis of total assigned operating and other expenses, excluding general office expenses
Transportation		
371. Superintendence	Apportioned on basis of payroll charges to all transportation accounts, including outside operations; being the ratio that the aggregate of charges to this account bears to the total payroll charges as above	Assigned direct wherever possible, otherwise apportioned on basis of usage
§372. Despatching trains	Assigned direct wherever possible, otherwise apportioned on basis of trains handled	Assigned direct wherever possible, otherwise apportioned on basis of yard locomotive mileage
373. Station employees	Assigned direct	Assigned direct wherever possible, otherwise apportioned on basis of service performed
374. Weighing, inspection and demurrage bureaus 375. Coal and ore wharves	Assigned direct wherever possible, otherwise apportioned on basis of assigned charges	Assigned to freight
376. Station supplies and expenses	Assigned direct wherever possible, otherwise apportioned on basis of charges to Account 373	Apportioned on same basis as Account 373
377. Yardmasters and yard clerks	Assigned direct wherever possible, balance apportioned on basis of assigned charges	
378. Yard conductors and brakemen 379. Yard switch and signal tenders 380. Yard enginemen 381. Yard motormen 382. Fuel for yard locomotives 383. Yard switching power produced 384. Yard switching power purchased 385. Water for yard locomotives 386. Lubricants for yard locomotives 387. Other supplies for yard locomotives	Assigned direct wherever possible, otherwise apportioned on basis of yard locomotive mileage	Assigned direct wherever possible, otherwise apportioned on basis of yard locomotive mileage
388. Enginehouse expenses — Yard	Assigned direct to yards or enginehouses	Assigned direct wherever possible, otherwise costs determined per engine handled and apportioned on basis of yard locomotive mileage
389. Yard supplies and expenses	Assigned direct wherever possible, otherwise apportioned on basis of yard locomotive mileage	Apportioned on same basis used in apportioning charges to yards and terminals
390. Operating joint yards and terminals — Dr. 391. Operating joint yards and terminals — Cr.		Apportioned on basis of service

† Depreciation charges included with interest on investment; retirements not considered. ‡ Average cost per month determined, based on aggregate of charges to the account during the 12 months ended with the test period. § Only exclusive yard service considered.

lished in these cases. At the same time the problem here presents certain peculiarities, and much of the formula as devised to meet them is original.

Attention may be called to some of the characteristic items of the formula. Maintenance-of-way expenses, where not assignable direct, were apportioned between

Formula Employed in the Preparation of Cost Data and the Assignment of Expenses to Yards, Terminals and Other Operations — *Concluded*

Accounts	Bases for apportioning operating and other expenses to yards and terminals	Bases for apportioning operating expenses between freight and passenger service
Transportation — continued 392. Train enginemen 393. Train motormen 394. Fuel for train locomotives 395. Train power produced 396. Train power purchased 397. Water for train locomotives 398. Lubricants for train locomotives 399. Other supplies for train locomotives 400. Enginehouse expenses — Train 401. Trainmen 402. Train supplies and expenses 403. Operating sleeping cars	Not ordinarily yard service; when such expense is involved in yard or terminal operation the costs reflected by locomotive performance sheet are used and apportioned on basis of train locomotive mileage represented	Assigned direct
404. Signal and interlocker operation 405. Crossing protection 406. Drawbridge operation	Assigned direct wherever possible, balance apportioned on basis of assigned charges	Apportioned on basis of service performed
407. Telephone and telegraph operation		Apportioned on basis of telephones in service
¶408. Operating floating equipment		Assigned direct
409. Express service	No charge to be made	No charge to be made
410. Stationery and printing 411. Other expenses	Apportioned on basis of assigned charges to Account 371; being the ratio that the aggregate of charges to these accounts bears to the total charges to Account 371	Apportioned on same basis as Account 371
412. Operating joint tracks and facilities — Dr. 413. Operating joint tracks and facilities — Cr.	Assigned direct wherever possible, otherwise apportioned on basis of usage	Apportioned on same basis used in apportioning charges to yards and terminals
414. Insurance	Assigned direct	Assigned direct wherever possible, otherwise apportioned on basis of service performed
415. Clearing wrecks 416. Damage to property 417. Damage to live stock on right-of-way	Assigned direct wherever possible, otherwise apportioned on basis of yard locomotive mileage	
418. Loss and damage — Freight	Apportioned on basis of payroll charges to Accounts 373, 375, 377, 378, 380, 381, 392, 393, 401, 405 and 408; being the ratio that the aggregate of charges to this account bears to the total payroll charges to the above accounts	Apportioned on same basis used in apportioning charges to yards and terminals
419. Loss and damage — Baggage	No charge to be made	No charge to be made
420. Injuries to persons	Apportioned on basis of charges to Account 371	Apportioned on same basis used in apportioning charges to yards and terminals
Transportation — Water Line 431. Operation of vessels 432. Operation of terminals 433. Incidental	No charge to be made	No charge to be made
Outside Operations 441. Dining and buffet service 442. Hotels and restaurants	No charge to be made	No charge to be made
443 Grain elevators 444. Stock yards	Assigned direct wherever possible, balance apportioned on basis of assigned charges	Assigned to freight
445. Producing power sold	No charge to be made	No charge to be made
446. Other miscellaneous operations	Assigned direct wherever possible, balance apportioned on basis of assigned charges	Assigned direct wherever possible, otherwise apportioned on basis of usage
General 451. Salaries and expenses of general officers 452. Salaries and expenses of clerks and attendants 453. General office supplies and expenses 454. Law expenses 455. Insurance 456. Relief department expenses 457. Pensions 458. Stationery and printing 459. Valuation expenses 460. Other expenses	Apportioned on same basis as aggregate of charges to Accounts 351 to 359 inclusive	Apportioned on same basis as aggregate of charges to Accounts 351 to 359 inclusive
461. General joint facilities — Dr. 462. General joint facilities — Cr.	Assigned direct	Assigned direct wherever possible, otherwise apportioned on basis of usage
Taxes 532. Railway tax accruals	Taxes computed on basis of assessed valuation of tangible property only, including locomotives but not cars; main stem apportioned on basis of road mileage; balance assigned direct	Assigned direct wherever possible, otherwise apportioned on basis of usage
**Interest and depreciation on locomotives	Assigned direct wherever possible, otherwise apportioned on basis of yard locomotive mileage	Apportioned on same basis used in apportioning charges to yards and terminals
††Interest on investment other than locomotives		

¶ Assignment between floatage and lighterage arrived at on basis of tugboat performance.

** Interest on investment 5 per cent and depreciation 4 per cent on locomotives; computed on basis of ledger value of equipment assigned to yards and terminals.

†† Interest on investment 5 per cent; computed on basis of assessed valuation as shown by the tax return.

freight and passenger traffic on the basis of usage. The freight portions, where covering two or more yards, were apportioned on the basis of the assigned charges; that is, proportional to the relative known charges against the corresponding yards. Maintenance of equipment, where not chargeable direct, was apportioned on the basis of usage or output. And so on through the list a variety of means were employed to fix the proper charge against the terminal operations.

In the case of some items, such as those chargeable to floating equipment, the problem was not merely one of allocation, but of determining the fair average for items fluctuating widely as between months.

Consideration was given to the present high rates for money, and inasmuch as it is problematical what the rates will be in the future, the costs are in general worked up on the bases of the three rates of 5, 6 and 7 per cent.

The costs include all of the terminal operations in either direction covered by the rate or paid for by the carrier — between break-up yard and pier station or inland freight-house platform, tailboard at team tracks, ship side or deck of pier in the case of lighterage service. The items were so grouped as to show the cost per car (all cars), per loaded car and per net ton, subdivided by major operations. No attempt was made in the composite figures to differentiate between inbound and outbound traffic, as the allocation of many items could at best be made only on an arbitrary basis.

1914 FIGURES BROUGHT TO A 1918 BASIS

Granted that it was necessary to go back to 1914 to find a normal traffic, it is evident that the basic cost figures must be drawn from the same year and the same conditions. On the other hand costs of labor and material have advanced by leaps and bounds since 1914, and it would be unsafe to found analyses of contemplated projects on the assumption that the price level of 1914 will be restored. The 1914 costs had therefore to be brought to a more recent basis — to that of 1918, which may be regarded as more nearly the basis of the future.

What it would have cost to handle the traffic of 1914 in the same manner as in 1914, but with 1918 unit prices, was considered the criterion, rather than what it actually did cost in 1918, under abnormal war conditions, to handle an abnormal traffic. To arrive at this the field force of the statistical department visited the railroad offices and examined individual items covering expenditures for each class of material and labor, such as rails, ties and other track material, and wages of trainmen, enginemen, shopmen and sectionmen. These were compared with similar figures for 1914 items of expense, and percentages reflecting the average increases in unit prices from 1914 to 1918 were derived. This was a laborious task, as it involved an examination of wage and payroll schedules of all classes of employees and hundreds of invoice records.

The various percentages so obtained were then applied to the allocated costs on the 1914 basis. This gave new sets of totals by major operations, which were translated as before into costs per car, per loaded car and per ton.

Special Statistical Studies

Following are some of the special statistical studies made by the Commission's forces, mainly in connection with the analysis of the Manhattan freight problem.

WASTED EFFORT

There is a large movement of empty cars in all directions in the Port of New York. Obviously this movement contributes heavily to the expense of terminal operations. Since the inbound tonnage is far more than the outbound, owing to the large local consumption of food, coal and other products and the excess of exports over imports, there are certain to be empty cars outbound. But the records show that at Manhattan stations nearly as many cars are brought to the stations empty as depart empty. The loss of effort due to this condition was made the subject of a special study. This did not involve the collection of any additional data, other than general information as to the prevailing operating conditions at the Port, but it required an analysis of the traffic at each station, the effect of the balance of traffic, or lack of it, and the average loading at the station on the situation as a whole. The results of this study are set forth on page 165.

CAR DETENTION

Every car represents capital invested, and has a potential earning power. These facts are recognized by the per diem rates its owner is permitted to charge other railroads for the time they hold the car, whether or not it is at the time earning them anything. When we compare the average daily mileage of all freight cars of about 26 miles with speed in transit ranging from a low figure of 5 miles per hour to upward of 30 miles per hour, we see that the car must stand still in yards and terminals much of the time.

Several of the West Side and Manhattan freight projects analyzed by the Commission contemplate bringing the car direct to the terminal as at present. Others contemplate transfer of the load and prompt release of the car on the New Jersey side. A special study was made to determine what the difference would be, in car-hours and also in per diem charges. This study involved a tracing through from break-up yard to terminal and back to break-up yard of the records of a sufficient number of cars to afford a reliable average.

YARD STUDIES

In connection with the main cost analysis two comprehensive special studies were made. One covered the cost of handling freight over the transfer platforms at one of the break-up yards, taking into account the time and amount of labor employed for each operation, the trucking distances covered and the average truck loads, as revealed by the 1918 clockings. The other went into the cost of breaking up, switching and making up trains in classification yards, as shown by both the statistical data and the clockings. Both studies were used in arriving at the approximate costs of operating facilities embodied in certain of the proposed plans.

III — EXISTING FACILITIES AND METHODS

Twelve railroads operate trains into and out of the Port of New York. They are distributed as shown on Fig. 2, Part IV. Nine of them — the West Shore, the New York, Ontario & Western, the Delaware, Lackawanna & Western, the Erie, the Pennsylvania, the Central of New Jersey, the Lehigh Valley, the Baltimore & Ohio and the Philadelphia & Reading — are designated as New Jersey railroads because they enter the District from New Jersey. The freight railheads of all are in New Jersey except that of the Baltimore & Ohio, which crosses the Arthur Kill and terminates in Staten Island, but does not enter any other part of New York City or State except by floating operations. The remaining three railroads of the Port — the New York Central, the New York, New Haven & Hartford and the Long Island — are referred to as the New York railroads, because so far as the Port District is concerned their rails lie wholly within New York State.

There are also a number of independent short lines. One of these, the Hoboken Shore Road, in the city of Hoboken, handles a heavy volume of traffic to and from various of the trunk lines. The Rahway Valley, the Raritan River, the Morristown & Erie and the Government railway on Sandy Hook, all in New Jersey, have only very light traffic.

Facilities of Each Railroad

The general extent of the twelve principal railroads is set forth in Chapter 5 — "History of New York's Railroad Development." The facilities of each for doing business within the Port can be briefly summarized. Under the heading "Float-Bridge Terminals," are included only terminals dependent upon float-bridges for rail access, as distinguished from general waterfront yards.

NEW YORK CENTRAL

Main Lines — Main double-track freight line on east side of Hudson River, south to St. Johns Park in lower Manhattan (West Side line). Main electrified, passenger line leaving Hudson River at Spuyten Duyvil and running to Grand Central Terminal, Forty-second Street and Park Avenue, Manhattan, via Mott Haven Junction; no freight service on this line within Manhattan.

Secondary Lines — Harlem division, north from Mott Haven Junction through Mount Vernon and White Plains; Putnam division, single-track, north from High Bridge between Hudson and Harlem divisions, with short branch for passenger service only to Yonkers. Short double-track freight branch from Melrose Junction to Westchester Avenue Station and thence to Port Morris on East River. Industrial branch from Putnam division to large industries along Nepperhan River in Yonkers.

Principal Yards — Combined break-up and waterfront yard at Sixtieth Street and Hudson River, Manhattan; largely flat switching and stub tracks. Terminal yard, flat switching, at Thirty-third Street on West Side line. Freight and coach yard at Mott Haven. Waterfront yard at Port Morris. Coach and express yard at Grand Central Terminal.

L. C. L. Transfer Station — Yonkers.

Icing Station — None; icing done at Thirty-third Street and at Manhattanville.

All-Rail Stations — St. Johns Park; Thirty-third Street Terminal, West Side line; Sixtieth Street Terminal, West Side line; Manhattan Street, West Side line; Inwood, West Side line, High Bridge, Morris Heights, Kings Bridge, Melrose, Westchester Avenue and Port Morris, in the Bronx; stations at Yonkers, Mount Vernon, White Plains and smaller points north of New York City.

Pier Stations — Piers 16, 17, 23, 31 and 83, Hudson River, Manhattan, and bulkhead at West 142nd Street; Piers 4, 34 and 35, East River, Manhattan; Wallabout Basin, Brooklyn.

Float-Bridge Terminals — None except on West Side line.

Float Bridges — Four at Sixtieth Street yard, two (not in use at present) at Thirty-third Street yard.

General Lighterage Piers — One open and six covered piers at Sixtieth Street yard, one open and two covered piers at Thirtieth Street yard, two open piers at Port Morris.

Express Stations — Thirty-third Street yard and Grand Central Terminal.

Coal Terminal — None.

Grain Elevator — Fifty-ninth Street and Hudson River, Manhattan.

Milk Stations — Thirty-third Street, West Side line; Manhattan Street, West Side line; Mott Haven yard.

Stock Yards — Sixtieth Street yard.

Marine Equipment — Ten ferry boats, 21 tugs, 63 car floats, 7 steam lighters, 37 hoisting barges, 174 barges, scows or grain boats, besides floating pile drivers and equipment for company use.

In addition to the foregoing trackage and terminals, all on the east side of the Hudson River, the New York Central leases and operates the West Shore Railroad as part of the New York Central and has full use of all its facilities on the west side of the river. The marine equipment above mentioned includes that used by the West Shore Railroad.

WEST SHORE

Main Line — Double-track freight and passenger line from Weehawken through Bergen Hill and north inland from Hudson River to boundary line of Port District.

Secondary Line — New Jersey Junction Railroad, a belt line from Weehawken across main lines of Lackawanna and Erie railroads to junction with main line of Pennsylvania and also with belt line of Lehigh Valley (National Docks Railway); also running north along waterfront to junction with Erie Terminals Railroad.

Principal Yards — Break-up yard at New Durham (Granton); flat switching. Waterfront and make-up yard at Weehawken; flat switching. Storage yard at Little Ferry (Bellman's).

L. C. L. Transfer Stations — Weehawken yard.

Icing Station — Weehawken yard.

All-Rail Stations — Weehawken, small stations along New Jersey Junction Railroad, and also along main line.

Pier Stations — Same as New York Central.

Float-Bridge Terminals — Same as New York Central.

Float Bridges — Six at Weehawken.

General Lighterage Piers — Seven open and four covered piers at Weehawken.

Coal Terminal — None.

Grain Elevators — Two at Weehawken.

Milk Station — Weehawken.

Stock Yards — None.

Marine Equipment — Same as New York Central.

NEW YORK, ONTARIO & WESTERN

Main Line — Trackage rights over West Shore Railroad from Cornwall, N. Y., to Weehawken.

Coal Terminal — Trestle at West New York.

Other Terminal Facilities — Served by West Shore Railroad at inland stations, principally Pier 23, Hudson River.

Marine Equipment — Two sea-going tugs, 5 ocean barges, 3 sound barges, 21 harbor boats.

DELAWARE, LACKAWANNA & WESTERN

Main Lines — Four-track line from Hoboken through Bergen Hill, thence double-track through Secaucus, Passaic, Paterson, Boonton and Denville. A second double-track line, used mainly for passenger service, from junction west of Bergen Hill through Newark and Summit to Denville.

Secondary Line — Double-track branch line from Newark to Montclair.

Principal Yards — Break-up yard at Secaucus; a modern hump yard, with separate humps for classifying miscellaneous inbound freight and inbound coal. Waterfront yard at Hoboken.

L. C. L. Transfer Station — Secaucus yard.

Icing Platform — Hoboken.

All-Rail Stations — Hoboken terminal; Newark, Passaic, Paterson, East Orange, Orange, Montclair, Summit and smaller towns in New Jersey.

Pier Stations — Piers 13, 41 and 68, Hudson River, Manhattan; Pier 26, East River, Manhattan.

Float-Bridge Terminals — Wallabout Basin Terminal and Twenty-fifth Street Terminal, Brooklyn; Harlem Terminal, the Bronx (owned by Lackawanna and used jointly by Lackawanna, Erie and Baltimore & Ohio).

Float Bridges — Six at Hoboken, one at Wallabout Basin, one at Harlem Terminal.

Express Station — Hoboken.

General Lighterage Piers — Four open piers and four covered piers at Hoboken.

Grain Facilities — Trestle at Hoboken.

Coal Terminal — Two car dumpers at Hoboken.

Milk Station — Hoboken.

Stock Yards — None.

Poultry Yard — Hoboken.

Marine Equipment — Fifteen ferry boats, 15 tugs, 28 car floats, 5 steam lighters, 48 lighters, 42 covered barges, 33 grain boats, 30 coal boats.

ERIE

Main Lines — Six-track line from Jersey City through Bergen Hill, thence four-track and double-track through Secaucus, Rutherford, Passaic, Paterson and Ridgewood. Double-track freight detour from Rutherford through Garfield to Ridgewood.

Secondary Lines — New York, Susquehanna & Western Railroad, principally coal-carrying, from Edgewater through Bergen Hill, Hackensack, Paterson and Hawthorne, with connection south along east edge of Hackensack Meadows to main line and Pennsylvania Railroad, and industrial branch to Garfield. Northern Railroad of New Jersey, from junction with main line west of Bergen Hill through New Durham and Englewood to Piermont and Nyack. New Jersey & New York Railroad, from junction with main line near Rutherford through Hackensack and Westwood to New City, N. Y. Greenwood Lake division, from junction west of Bergen Hill through Kearny, Belleville, Montclair and Little Falls to Greenwood Lake, with short branches to West Orange and Caldwell. Newark branch, from junction with Greenwood Lake division near Hackensack River through North Newark, Belleville and Nutley to Paterson. Double-track freight branch from junction with main line east of Bergen Hill to Weehawken waterfront terminal. Erie Terminals Railroad, a waterfront industrial line running south from Edgewater terminal to junction with New Jersey Junction Railroad, and north to Edgewater ferry.

Principal Yards — Break-up yard at Secaucus (Croxton yard); a modern hump yard with an inbound and an outbound hump. General waterfront yard at Jersey City, with float bridges, lighterage piers, grain elevator and miscellaneous local facilities. Waterfront yard at Weehawken with lighterage piers, float bridges and some local facilities. Waterfront yard, principally for coal, at Edgewater (Undercliff). Classification and storage yard for serving Edgewater yard at Little Ferry or Undercliff Junction; flat switching.

L. C. L. Transfer Station — Croxton yard.

Icing Stations — Croxton yard and Jersey City.

All-Rail Stations — Jersey City, Weehawken and Edgewater terminals; Passaic, Paterson, Newark, Montclair, Hackensack and numerous smaller New Jersey points.

Pier Stations — Piers 20, 21 and 39, Hudson River, Manhattan; Pier 7, East River, Manhattan.

Float-Bridge Terminals — Twenty-eighth Street and Eleventh Avenue, Manhattan; Wallabout Basin, Brooklyn; Harlem Terminal, 133rd Street and Harlem River, the Bronx (owned by the Lackawanna).

Float Bridges — Four at Jersey City, one at Weehawken, one at West Twenty-eighth Street, Manhattan, and the use of one at Harlem Terminal.

General Lighterage Piers — Four covered piers at Jersey City, five covered and two open piers at Weehawken, one covered pier at Edgewater.

Express Station — Jersey City.

Grain Elevator — One at Jersey City.

Coal Terminals — Car dumper and trestle at Undercliff, trestle at Weehawken.

Milk Station — Jersey City.

Stock Yards — Jersey City.

Marine Equipment — Eleven ferry boats, 15 tugs, 1 combination steam lighter and tug, 36 car floats, 6 steam barges, 138 covered barges, 60 open barges, 3 steam hoists.

PENNSYLVANIA

Main Lines — Original four-track main line, from Jersey City through Bergen Hill, Newark, Elizabeth, Rahway and New Brunswick. Line for passenger service only from Manhattan Transfer on main line near Harrison under Bergen Hill and Hudson River to Pennsylvania Station, Thirty-third Street and Seventh Avenue, Manhattan. Double-track freight line from Waverly yard, Newark, across Newark Bay to Greenville, Jersey City. Freight detour from Waverly yard to Meadows yard. Double-track line from Bay Ridge, Long Island, opposite Greenville, to connection with New York, New Haven & Hartford Railroad in the Bronx, via Long Island Railroad, leased by Pennsylvania, to East New York, and thence via New York Connecting Railroad, owned jointly by Pennsylvania and New York, New Haven & Hartford.

Secondary Lines — Line from Rahway to Perth Amboy, thence southwest approximately parallel with main line. Trackage rights over Central Railroad of New Jersey (New York & Long Branch Railroad) from South Amboy southeast through Matawan to New Jersey coast resorts. Connection from old main line east of Bergen Hill to Harsimus Cove waterfront yard in Jersey City north of original Jersey City yard.

Principal Yards — Break-up, classification and transfer yard at Waverly, in southern part of Newark; one classification hump for traffic in both directions. Break-up and classification yard on Hackensack Meadows west of Jersey City (Meadows yard); flat switching. Waterfront yard at Greenville, mainly for interchange, export and import traffic; a modern yard with gravity switching. Two waterfront yards at Jersey City, one known as South Jersey City, the other as Harsimus Cove.

L. C. L. Transfer Station — Waverly.

Icing Stations — Greenville and Harsimus Cove.

All-Rail Stations — South Jersey City and Harsimus Cove terminals; Newark, Elizabeth, New Brunswick, Perth Amboy and smaller New Jersey points.

Pier Stations — Piers 3, 4, 5, 27, 28, 29, 77 and 78, Hudson River, Manhattan; Pier 22, East River, Manhattan; East 125th Street, Harlem River, Manhattan; two piers at North Fourth Street, Williamsburg, Brooklyn, and one at Wallabout Basin, Brooklyn.

Float-Bridge Terminals — One at Thirty-seventh Street and Eleventh Avenue, Manhattan, in conjunction with Piers 77 and 78; one at North Fourth Street, Williamsburg, in conjunction with the two piers at that point.

Float Bridges — Three at South Jersey City yard, five at Harsimus Cove, four at Greenville, one at West Thirty-seventh Street (Manhattan) inland station, and one at Williamsburg station. Car ferry from Greenville to Bay Ridge, principally for New York, New Haven & Hartford interchange.

General Lighterage Piers — Three covered and one open pier at South Jersey City (two of the covered piers being under lease to a steamship company); four open and two covered piers at Harsimus Cove; one open and one covered pier at Greenville.

Express Stations — Jersey City; Thirty-third Street Station, Manhattan.

Grain Facilities — None at present, an elevator at Harsimus Cove having been torn down a few years ago following the opening of a large new elevator by the Pennsylvania at Philadelphia

Coal Terminals — Two car dumpers at South Amboy, trestle at Harsimus Cove, trestle at Greenville.

Milk Station — None; small amount of milk handled at local stations.

Stock Yards — Jersey City.

Poultry Yard — Harsimus Cove.

Steel Storage Yard — Greenville yard; a large uncovered area served by tracks widely spaced, for the storing of structural steel, bridge members and the like, the only yard of its kind in the Port.

Marine Equipment — Twenty-three ferry boats, 27 passenger and freight steamboats, 55 tugs, 124 car floats, 9 steam lighters, 226 barges, 20 canal barges, 50 flat dumps and scows, and various smaller vessels and construction boats — the foregoing including equipment available for service on all lines of the Pennsylvania Railroad system December 31, 1917.

LEHIGH VALLEY

Main Line — Double-track freight line from Jersey City (south of Morris Canal Basin) across Newark Bay and through Newark, Cranford, South Plainfield and Bound Brook. The Lehigh Valley has no passenger terminal of its own; its passenger trains run from the Pennsylvania station in Manhattan, connecting with the Lehigh Valley in the vicinity of Waverly yard, Newark.

Secondary Line — Double-track belt line, the National Dock Railway, from Constable Hook, Bayonne, to connection with New Jersey Junction Railroad in Jersey City, with spur to Black Tom Island. Freight branch, mainly for coal traffic, from South Plainfield to Perth Amboy, with short branches to Raritan River. Short spur from main line to Irvington.

Principal Yards — Break-up yard at Oak Island, Newark; a hump yard. Waterfront yard at Jersey City (along Morris Canal Basin). Classification yard for Black Tom terminal at Claremont, in southern part of Jersey City. Classification yard at Perth Amboy.

L. C. L. Transfer Station — Oak Island yard.

Icing Station — Jersey City.

All-Rail Stations — Jersey City and Perth Amboy terminals; Newark, Irvington and smaller New Jersey points.

Pier Stations — Piers 8, 34 and 66, Hudson River, Manhattan; Pier 44 and a pier at East 124th Street, Harlem River, Manhattan; Wallabout Basin, Brooklyn. (Stations at Battery Place, Hudson River, Manhattan, and East 43rd Street, East River, Manhattan, were recently discontinued.)

Float-Bridge Terminals — One at Twenty-seventh Street and Eleventh Avenue, Manhattan, and one at East 149th Street, Harlem River, the Bronx.

Float Bridges — Six at Jersey City terminal, two at Black Tom, one at West Twenty-seventh Street, Manhattan, and one at East 149th Street, the Bronx.

General Lighterage Piers — Four open and five covered piers at Jersey City terminal, one open and two covered piers at Black Tom, two little used open piers at Perth Amboy.

Grain Facilities — Two elevators at Black Tom.

Coal Terminal — Car dumper and coal trestle at Perth Amboy.

Milk Station — Jersey City.

Stock Yards — Jersey City.

Warehouses — Five at Black Tom.

Ore-Handling Water Terminal — Constable Hook, Bayonne.

Marine Equipment — Twenty tugs, 31 car floats, 16 steam lighters, 241 barges, 3 cattle boats, 24 service boats.

Central of New Jersey

Main Lines — Four-track line from Jersey City terminal through Bayonne, double-track across Newark Bay, four-track through Elizabeth, Westfield, Plainfield and Bound Brook. Line from Elizabethport through Roosevelt and Perth Amboy to coast resorts.

Secondary Lines — Double-track line from Jersey City terminal to Newark. Line from Newark to Elizabethport. Line along Arthur Kill from Elizabethport to Chrome (Roosevelt). Industrial spur to Constable Hook and another to Port Johnson, both in Bayonne. Several short industrial spurs along Arthur Kill.

Principal Yards — Main break-up and waterfront yard at Jersey City; flat switching. Classification yard at Elizabethport. Classification yard at Newark (Brills yard) to serve industries at Newark. Classification yard at Bayonne to serve industries at Bayonne and coal terminal at Port Johnson.

L. C. L. Transfer Station — Elizabethport yard.

Icing Station — None; icing and transfer work done at small platform in Jersey City yard.

Pier Stations — Piers 10, 11, 39, 46 and 81, Hudson River, Manhattan.

All-Rail Stations — Jersey City terminal, Newark, Elizabeth, Bayonne, Perth Amboy and smaller New Jersey points.

Float-Bridge Terminal — Bronx terminal, Harlem River and East 133rd Street, the Bronx.

Float Bridges — Five at Jersey City terminal, one at Bronx terminal.

General Lighterage Piers — Nine open and three covered piers at Jersey City terminal.

Express Station — Jersey City.

Grain Facilities — None.

Coal Terminals — Two car dumpers and two trestles at Jersey City terminal; trestle at Port Liberty; trestle at Port Johnson, Bayonne; two trestles at Elizabethport.

Milk Station — None; small amount of milk handled at local stations.

Stock Yard — Jersey City terminal.

Ore Terminal — Elizabethport.

Marine Equipment — Ten ferry boats, 3 steamboats, 13 tugs, 31 car floats, 16 lighters, 36 steam hoist lighters, 7 steam-derrick lighters, 33 hand-hoist lighters, 44 covered barges.

Baltimore & Ohio

Main Line — Freight line from terminal at St. George, Staten Island, through Port Richmond and across Arthur Kill to junction with Central Railroad of New Jersey at Cranford.

Secondary Line — Line of Staten Island Rapid Transit Railway from St. George to Tottenville, with short branch to Fort Wadsworth.

Principal Yards — Break-up yard at Arlington, on Staten Island west of Port Richmond. Waterfront terminal at St. George.

L. C. L. Transfer Station — St. George.

All-Rail Stations — Main terminal at St. George; small stations elsewhere in Staten Island.

Pier Stations — Pier 22, Hudson River, Manhattan; Pier 21, East River, Manhattan; Wallabout Basin, Brooklyn.

Float-Bridge Terminals — West Twenty-sixth Street and Eleventh Avenue, Manhattan; Harlem Terminal, 133rd Street and Harlem River, the Bronx (owned by Lackawanna).

Float Bridges — Four at St. George, one at West Twenty-fifth Street, Manhattan, use of one at Harlem Terminal.

General Lighterage Piers — Two covered piers and six open piers at St. George.

Grain Facilities — None.

Coal Terminals — Car dumper and two trestles at St. George; car dumper at Arlington.

Milk Station — None; small amount of milk handled at local stations.

Stock Yards — None.

Marine Equipment — Thirteen tugs, 49 car floats, 3 steam lighters, 92 lighters, 8 steam-derrick lighters.

Philadelphia & Reading

Main Coal Line — From Port Reading on Arthur Kill north of Perth Amboy to junction with main passenger line near Bound Brook.

Secondary Line — None.

Principal Yard — Waterfront coal yard at Port Reading.

All-Rail Stations — None.

Pier Stations — None.

Float-Bridge Terminals — None.

Lighterage Piers — None.

Coal Terminal — Car dumper and three piers at Port Reading.

Grain Facilities — None.

Milk Station — None.

Stock Yards — None.

Marine Equipment — Twenty tugs, 35 car floats, 72 barges, 7 miscellaneous pieces of floating equipment.

New York, New Haven & Hartford

Main Lines — Main four-track electrified line, chiefly for freight, from waterfront terminal near mouth of Harlem River through Pelham Bay Park to junction with main passenger line at New Rochelle. Main electrified passenger line from junction with New York Central at Woodlawn, near north boundary of New York City, through Mount Vernon, New Rochelle and Port Chester. Joint ownership with Pennsylvania Railroad of four-track New York Connecting Railroad from Harlem River terminal at Port Morris to junction with Long Island Railroad extending to Bay Ridge for freight service and to Thirty-third Street Station of Pennsylvania Railroad for passenger service.

Secondary Line — New York, Westchester & Boston Railroad from West Farms to White Plains, with branch to New Rochelle, for passenger service only.

Principal Yards — Break-up yard at Oak Point, the Bronx; electrified yard. Waterfront yard at Harlem River, Port Morris. Auxiliary yards at Van Ness and Westchester.

L. C. L. Transfer Station — Westchester.

All-Rail Stations — Harlem River terminal; Mount Vernon, New Rochelle, Port Chester and smaller points both within and outside of the city limits of New York City.

Pier Stations — Piers 31, 37, 38, 39, 40, 41, 42 and 70, East River, Manhattan.

Float-Bridge Terminals — None.

Float Bridges — Eight at Oak Point, two at Harlem River.

General Lighterage Piers — Bulkheads at Oak Point and Harlem River.

Coal Terminal — None.

Grain Facilities — None.

Milk Station — Harlem River.

Stock Yard — None.

Marine Equipment — One ferry boat, 18 tugs, 54 car floats.

Long Island

Main Lines — Steam line from Long Island City waterfront passenger and freight terminals through Winfield Junction to Jamaica, thence one line east through Hollis to Greenport and one farther to the south through Rosedale to Montauk Point. Electrified passenger and freight line from Flatbush Avenue terminal, Brooklyn, to junction with foregoing lines at Jamaica. Electrified passenger line from Pennsylvania Station, Manhattan, to junction with Long Island City line at Long Island City.

Secondary Lines — Line from Winfield Junction through Flushing to Port Washington, with branch to Whitestone. Freight line from Bushwick terminal to junction with other lines at Jamaica. Line from East New York to Bay Ridge, with branch to Coney Island. Line from Woodhaven to Hammel and thence to Rockaway Park on west and junction with Montauk line on east. Various short connecting links.

Principal Yards — Break-up yard at Holban, east of Jamaica. Classification yard and Pennsylvania coach yard at Sunnyside, Long Island City.

All-Rail Stations — Long Island City, Flatbush Avenue and Bushwick terminals; smaller stations in Jamaica, Flushing and numerous other points in Long Island.

Pier Stations — Pier 22, East River, Manhattan.

Float-Bridge Terminals — None.

Float Bridges — Four at Bay Ridge.

Marine Equipment — Four ferry boats, one steamer, 5 tugs, 12 car floats.

Typical Railroad Operations

The foregoing list of facilities becomes more understandable when we trace through some of the typical operations. The combination of the great volume of business done at the Port and the large utilization of and dependence on water service make New York unique among ports, with problems not solvable by the experience of any other port.

NEW JERSEY RAILROADS

With the exception of the New York, Ontario & Western and the Philadelphia & Reading, the operations of all of the New Jersey railroads are substantially the same. Incoming trains as a rule come to a "break-up" yard, usually on relatively cheap land some miles back from the waterfront, where the cars are classified according to local destination. Less-than-carload freight is consolidated for individual stations at transfer platforms, and perishable food is iced. Short trains are then despatched to the waterfront yards, where the cars are more minutely classified. Some of the roads maintain icing stations at the waterfront yards.

Cars for the local New Jersey stations or industries are switched out to those stations or industries. Cars containing coal or grain — two commodities brought to the Port in large quantities and requiring special facilities — are diverted to those facilities, which consist of elevators, trestles or car dumpers for effecting transshipment between car and barge or ship.

Some of the break-up yards are at the waterfront, eliminating the short hauls between yards. Some of the railroads with interior break-up yards run a considerable number of trains direct to the waterfront and make only one classification of the cars. Several of the roads have separate coal terminals removed from the more congested part of the harbor, and reached by spurs from the main lines.

MARINE SERVICE

Freight for Manhattan, Brooklyn or the other boroughs of New York City is handled in one of four principal ways, all involving water transportation. In the case of miscellaneous package freight, cased food products and the like — such commodities as are ordinarily handled at railroad freight stations — the cars containing them are run upon car floats and towed to pier stations, where the cars are unloaded and reloaded without removal from the floats. In the case of certain bulk commodities and large pieces — goods ordinarily handled between cars and drays at team tracks, with or without the aid of cranes — the cars may be taken across the river on car floats, but are then hauled off to inland yards near the waterfront. These yards are provided with team tracks and freight-handling cranes, and usually also with freight houses for handling package freight. Not all of the roads have inland yards. The third class of commodity is the large shipment which is to go direct to a waterfront receiving point of the consignee. Such commodities are transferred from the cars to lighters at the New Jersey waterfront and lightered to the desired point. The fourth class consists of New Jersey produce, milk, poultry and certain other commodities which are transferred from the cars to drays at the New Jersey waterfront and brought to New York by ferry.

Goods for local delivery on either the New York or the New Jersey side of the river have thus been accounted for, and this group includes large quantities of freight reshipped by rail, water or truck. There remain, however, two important groups, freight to be transferred from cars to transoceanic or coastwise ships, and freight to be delivered to another railroad and carried on through the Port.

Freight for transshipment from car to ship may be delivered to a local consignee and later taken as a separate operation to the ship; it may be transferred direct from car to ship on a pier in New Jersey, or it may be in the case of one or two commodities taken to the ship's side on car floats, but the great bulk of it is transferred by lighter. To make possible these lighterage operations, both for deliveries to ship and for local deliveries, the New Jersey railroads have a considerable number of lighterage piers, some covered and some open, the latter in general designed to handle coarse freight and equipped with cranes of some sort. The goods are loaded from the piers upon harbor craft appropriate for the commodity, the harbor craft are towed to the ship or its pier and the cargo is transferred either directly over the ship's side or indirectly via the pier.

Transfer-Platform Operations — Trucking Through Cars

Cars containing through freight for interchange between certain of the New Jersey railroads are trans-

Typical Freight Transfer Platform at Break-Up Yard, Used to Some Extent for Breaking Bulk and Classifying Inbound Package Freight but Principally for the Consolidation of Outbound Shipments Into Carload Lots or Station Order

ferred via existing belt lines. Interchange between the New Jersey and New York railroads, which constitutes most of the railroad interchange, and also a considerable part of that between different New Jersey railroads, is effected by car float. The Pennsylvania tunnels under the Hudson and East Rivers are not used for freight traffic, and floating operations are virtually the only means of interchange between the New Jersey and the New York railroads. In one or two grave emergencies freight has been hauled through the Pennsylvania tunnels, but the tunnel franchise is for passenger service.

Outbound freight is handled in all of the foregoing different ways in reverse order.

The New York, Ontario & Western Railway is a tenant of the West Shore Railroad. It has no main trackage and no terminals in the Port District except two coal trestles at West New York. Its miscellaneous freight is handled by the West Shore Railroad at the West Shore stations.

The Philadelphia & Reading Railway handles nothing but coal within the Port District. It has a coal terminal at Port Reading on the Arthur Kill, and a line of its own thereto. Its miscellaneous freight is turned over to the Central of New Jersey.

NEW YORK RAILROADS

In general the operations of the New York railroads are similar to those of the New Jersey railroads. They have their break-up yards, their waterfront yards, their float bridges, their car floats and lighters and their pier stations. The New York Central, coming from the west and competing with virtually all of the New Jersey railroads, has operations almost exactly comparable with those of the New Jersey railroads, except that its car-float and lighterage base is on the upper West Side of Manhattan instead of in New Jersey, and it floats its goods up and down the Hudson River instead of across it; and except also that it has a rail line running south from the break-up and waterfront yard at Sixtieth Street to St. Johns Park Terminal, within three-fourths of a mile of the city hall. This line gives the New York Central an advantage over the New Jersey roads that is more potential than actual, for the

Transfer-Platform Operations — Hand Trucking From Car to Car Across Platform reason that the line is expensive to operate and inadequate in capacity, so that the New York Central has to maintain pier stations alongside it on the West Side just as do the New Jersey roads.

The New York, New Haven & Hartford Railroad, serving the New England territory and having virtually no competition from the other railroads of the Port, differs from the New Jersey railroads and the New York Central in that it has no terminals on the West Side of Manhattan, and none in New Jersey. The character of its traffic is quite different from that of most of the railroads previously mentioned. Its interchange constitutes a large percentage of its total, and its inbound traffic is less than its outbound, mainly because it does not bring in large quantities of coal and grain as the New Jersey railroads do.

The Long Island Railroad also has a monopoly on its territory, and confines its operations to terminals in Brooklyn and Queens, one pier station on the East Side of Manhattan and interchange with the other railroads of the Port.

Manhattan Pier Stations

Modern land freight stations for large cities usually consist of parallel inbound and outbound houses, with a number of tracks between them, the tracks being arranged in pairs separated by covered platforms. This separates the inbound and outbound freight and makes it possible to load and unload a large number of cars simultaneously by trucking along the intermediate platforms and through the cars. The tracks are "pulled" several times daily to remove cars ready to be removed and place new cars. Street trucks handling inbound and outbound freight operate in driveways on opposite sides of the terminal, and so are kept well clear of each other. The inbound house is wider than the outbound to allow temporary storage of goods awaiting the consignees' trucks.

The Manhattan pier station is a rather crude imitation of such a terminal. The inbound station is the pier. The tracks and intermediate platforms alongside are provided by the car floats. The outbound house is across the shore end of the layout, part of the wide Marginal Way being occupied for that purpose. Trucks coming for inbound freight enter the pier and depart at the same point, driving upon the floor of the pier. Trucks bringing outbound freight back to and discharge their loads upon elevated bulkhead platforms on one or both sides of the pier. The typical pier station thus consists of a pier, part of the slip on each side, and bulkhead sheds along the ends of the slips; but two or three adjoining piers, with a correspondingly greater length of bulkhead shed, may be operated as one station.

Car floats for pier-station service carry two tracks with an intermediate platform level with the car floors the full length of the float. By means of gang planks from float to float at the ends, and gang planks from the pier to the platforms of the row of floats adjacent to it — usually one gang plank per float, placed near the middle, between cars — it is possible to truck longitudinally from the bulkhead the full length of the chain of floats and laterally to and from all cars on the floats adjacent to the pier (thus reaching two tracks). Because of the great length of gang plank required to bridge laterally from one float to another alongside, it is not the general practice to truck across from one float to another.

OPERATING PROGRAM

When the working day begins at the piers there have been placed floats bearing loaded cars alongside the pier and floats bearing empty cars end on at the bulkhead, the slip being lined one deep with floats so that loading and unloading can be carried on simultaneously — unloading over the sides of the floats to the pier, loading over the ends from the bulkhead. The empty cars may have been unloading alongside the pier the day before, or they may have been brought empty from the waterfront yard. (See page 165 with reference to the large movement of empty cars.) Additional floats are brought from time to time during the day, those whose cars cannot be loaded or unloaded at once being moored alongside the others. "Switching" is performed by tugs from time to time as the day progresses, and floats are removed or shifted to a new position; but the switching unit is necessarily the float and not the individual car, and the ten or twelve cars must remain together whether or not the operations on all are completed at the same time.

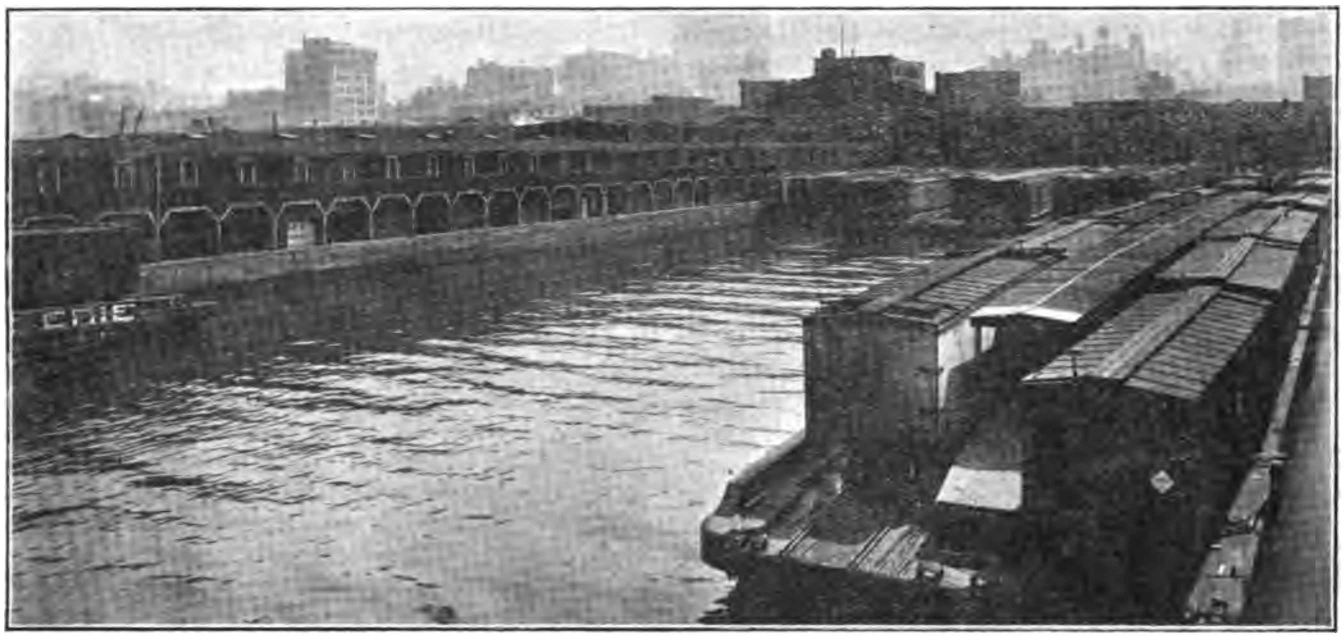
The majority of shippers find it convenient to bring their outbound freight well along in the day, and there is a consequent piling up of trucks just before closing time. A large percentage of the outbound cars are for this reason despatched in the evening. A time limit for the receipt of outbound freight is usually set at 4 or 4.30 P. M. to permit the carriers to complete the loading of the cars.

Except for certain commodities there is no established time for bringing inbound cars to the pier stations. Notice of the arrival of the goods is mailed to the consignee the day they reach the pier, and the consignee is allowed 48 hours, known as free time, from 7 A. M. the following day to remove them, pending which time the carrier must store them on the pier. This necessitates much piling up of goods, and searching and rehandling when the consignee's truck arrives.

Many of the outbound cars are loaded to destination. What are known as merchandise cars, cars containing less-than-carload lots all destined for single large centers or distant transfer points, are made up at a number of stations.

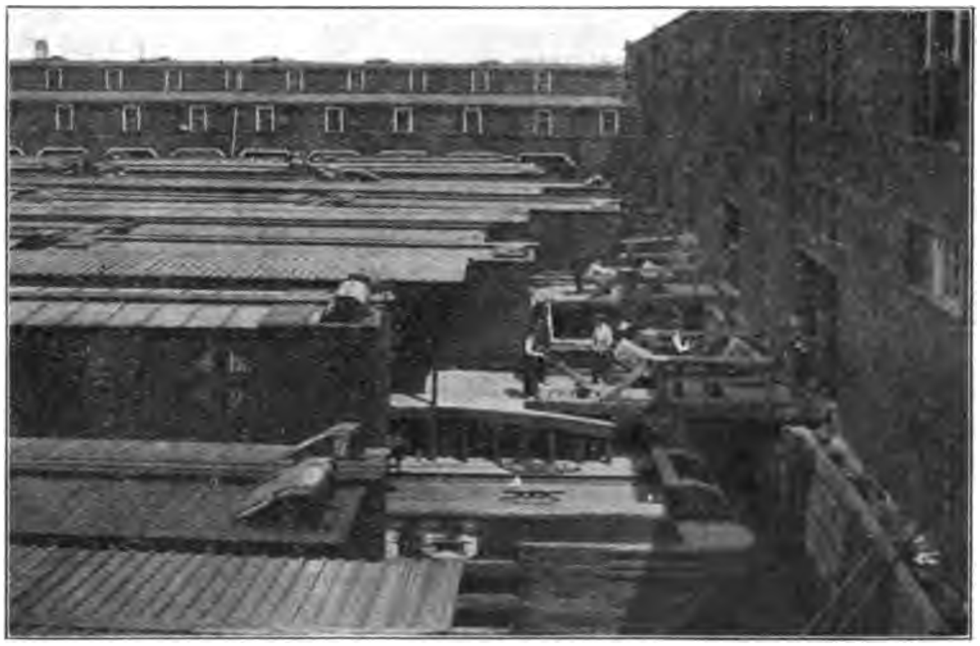
PERISHABLE FOOD

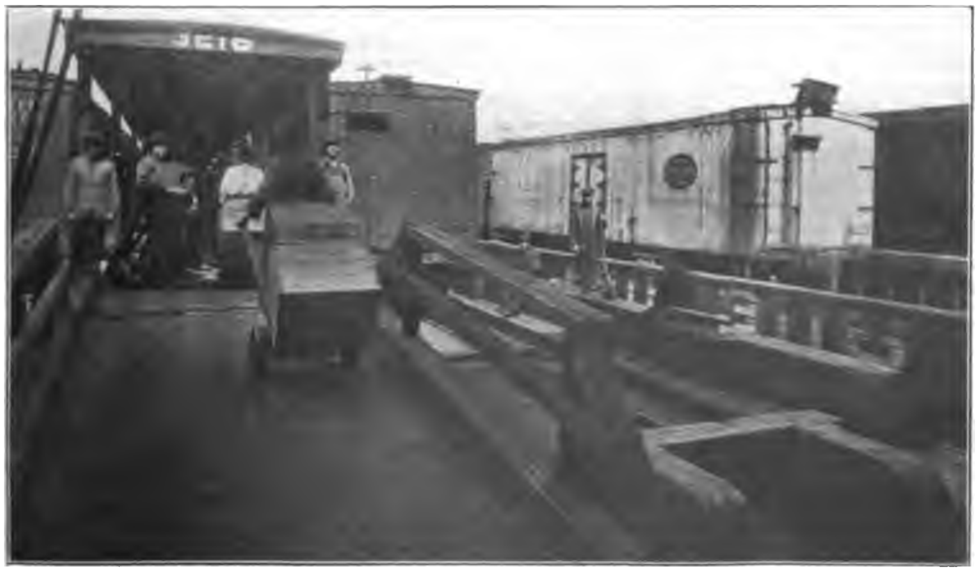
Perishable food constitutes a large and extremely important part of the Manhattan pier-station traffic. The movement is almost entirely inbound, and the railroad deliveries are made almost wholly in the lower West Side section opposite the primary market. (See Chapter 20.) Perishable food moves much more rapidly than other freight. Because it is handled in fast trains it is customary to send consignees notice of the arrival before the goods actually reach the terminal district, a practice not feasible with slower moving merchandise, and the consignees are ready for the goods when they reach the pier, which is usually during the fore part of the night. By early morning the



Car Floats in Inbound and Outbound Freight Service at Railroad Pier Station on Manhattan Waterfront

Car Floats at Railroad Pier Station Receiving Outbound Freight





Hand-Trucking Outbound Freight Across Bridge to Car-Float Platform goods have been unloaded, and in the case of certain goods, such as fruit, arranged for display and sampling. Auctions and other sales of certain kinds of fruit and produce are held on the piers, and the goods are removed during the day.

In front of a number of the food piers, on the Marginal Way, are covered platforms known as awning sheds or bonnets. Perishable food products not to be sold on the piers are trucked direct to the sheds to facilitate early removal.

NUMBER AND LOCATION OF PIER STATIONS

Owing to the constant expansion of the Manhattan pier-station traffic, and the demand for additional space, there are frequent changes in the railroad occupancy of the waterfront. In April of this year, when this chapter was written, there were twenty-seven piers in railroad use as pier stations on the Hudson River waterfront and seventeen on the East River waterfront of Manhattan south of Fifty-ninth Street. Table 1 shows the location, operating company, dimensions and other characteristics of the Hudson River pier stations, and Table 2 shows the corresponding information relative to the East River stations. Other piers on the Hudson River list in railroad use in 1914 and so included in the 1914 tonnage statements are Pier 2, Morris Street, Lehigh Valley; Pier 7, Rector Street, Baltimore & Ohio, and Pier 80, West Fortieth Street, Erie.

Piers 16 and 17 of the New York Central, 20 and 21 of the Erie and 27, 28 and 29 of the Pennsylvania are the principal railroad food piers.

At the present time the bulk of Manhattan's miscellaneous traffic is handled at the West Side stations. At the same time the stations in the most congested sections south of Fourteenth Street give indications that they have about reached the limit of their capacity, and the tendency toward expansion is along the East River and up the Hudson River north of Twenty-third Street.

OBJECTIONS TO PIER STATIONS

Obviously the pier station is not a model of economy in operation. It has inherent defects as compared with the ideal land station, and there are additional remediable defects due to faulty design.

In the first class of defects, the fact of accessibility at only one end is an inherent weakness. There cannot be complete separation of trucks arriving and departing. If there are delays the various truck lines are bound to foul each other.

Again, the operation of the cars cannot be ideal. Tidal fluctuations and inequality in the loading of the floats produce trucking grades that are bound to slow down the movements of the trucks, while the manifest impossibility of pulling tracks to rearrange the cars makes it necessary to hold back for hours cars that are ready for despatching, and remove others before they have obtained or discharged their loads.

Added to these inevitable disadvantages we have as remediable defects the narrowness of the average pier, and consequent congestion of teams and lack of storage space on the pier; the narrow entrances to the piers; the absence of second floors on the majority of the piers, and of team access to the few that exist; the use by street trucks of the pier floors, and the absence of loading platforms; the shortage of tailboard space for trucks bringing outbound freight. The net result is that both trucks bringing goods and trucks calling for goods have to line up along the Marginal Way, the truck lines overlap each other, and the congestion along West Street is greatly increased by the long lines of trucks that are often waiting for one of the numerous ferries.

The confusion along the Marginal Way at times is shown by several of the accompanying photographs. The effect in delays to trucks is set forth in Chapter 17 on trucking. The possibilities of improved design of the piers for the use of steamship companies are devel-

TABLE 1 — LOCATION, DIMENSIONS, CONTROL AND OTHER CHARACTERISTICS OF HUDSON RIVER PIER STATIONS

Station	Pier number	Nearest cross street	Railroad operating	Average dimensions of pier	Remarks
	3	Morris	Penna	480 x 43	
	4	Morris	Penna	418 x 80	
	5	Morris	Penna	438 x 80	
	8	Rector	L. V	754 x 75	Was operated by C. R. R. of N. J. in 1914.
	10	Albany	C. of N. J	732 x 80	
	11	Cedar	C. of N. J	754 x 50	Only one side open; ferry on other side.
	13	Fulton	D., L. & W	882 x 100	Steamship company has use of part of pier.
Barclay	16	Barclay	N. Y. C	711 x 50	Only one side open; ferry on other side.
	17	Park place	N. Y. C	926 x 70	Used mainly for inbound produce and general merchandise outbound.
Duane	20	Chambers	Erie	957 x 90	Busy terminal, heavy fruit business as well as general mdse.; awning shed.
	21	Duane	Erie	968 x 100	On marginal way; pier 20 open on one side only; pier 20 heated.
	22	Jay	B. & O	980 x 75	
	23	Harrison	N. Y. C. and W. S.	859 x 70	Mostly W. S. business; some W. S. business at Piers 16, 17, 31 and 83.
Desbrosses	27	Hubert	Penna	1001 x 75	General freight; busy terminal.
	28	Laight	Penna	1004 x 75	General freight and produce; shed on marginal way.
	29	Vestry	Penna	1007 x 80	Fruit and produce; pier heated; shed on marginal way.
	31	Desbrosses	N. Y. C	844 x 80	Only one side open; ferry on other side.
	34	Canal	L. V	842 x 90	
	39	Houston	C. of N. J	955 x 75	Part of pier used by C. R. R. of N. J.
	39	Houston	Erie	899 x 75	Erie leases limited space from C. R. R. of N. J.
	41	Leroy	D., L. & W	923 x 80	Awning shed on marginal way.
	46	Charles	C. of N. J	721 x 60	
	66	West 27th	L. V	512 x 80	Only one side open; B. & O. float bridge on other side; hay stored on outer half.
	68	West 28th	D., L. & W	621 x 50	Float bridge below south bulkhead; track down middle of pier.
	77	West 37th	Penna	524 x 60	Float bridge on north side.
	78	West 38th	Penna	500 x 60	Float bridge on south side.
	81	West 41st	C. of N. J	808 x 60	Part of pier used for railroad purposes.
	83	West 43d	N. Y. C	699 x 80	Only one side used.

Table 2 — Location, Dimensions, Control and Other Characteristics of East River Pier Stations

Pier number	Nearest cross street	Railroad operating	Average dimensions of pier	Remarks
4	Broad	N. Y. C.		Only one side open; Barge Canal terminal on other side; no bulkhead platforms.
7	Coenties Slip	Erie	571 x 60	Only one side open; Barge Canal terminal on other side.
21	Dover	B. & O.		Double-decked pier.
22	James Slip	L. I.	236 x 50	Piers 22 and 25 constitute joint station of Long Island and Pennsylvania, operated by former; both piers are one-sided piers on account of ferry slips.
25	Oliver	Penna.	300 x 40	
26	Catherine	D., L. & W	370 x 40	Part of pier used by Atlantic Fruit Company.
31	Pike Slip	N. Y., N. H. & H.		No bulkhead platforms.
34	Rutgers Slip	N. Y. C.		
35	Jefferson	N. Y. C.		Open uncovered bulkhead between Piers 34 and 35.
37	Clinton	N. Y., N. H. & H.		
38	Montgomery	N. Y., N. H. & H.		
39	Montgomery	N. Y., N. H. & H.		
40	Gouverneur Slip	N. Y., N. H. & H.		Busy terminal, inbound freight only.
41	Gouverneur Slip	N. Y., N. H. & H.		Open pier.
42	Gouverneur Slip	N. Y., N. H. & H.		
44	Jackson	L. V.	194 x 60	Double-decked pier.
70	East 22d street	N. Y., N. H. & H.		Only one side open, no bulkhead platform.

oped in Chapter 23. It is the conclusion of the Commission, however, as presented elsewhere in this report, that the use of valuable Manhattan waterfront by the railroads is incompatible with the rational development of the Port, and that the entire pier-station system should be abolished.

Inland Terminals

While the great bulk of Manhattan's local freight, other than that lightered, is handled at the pier stations, there are on the West Side four inland terminals operated by as many of the New Jersey railroads and reached from car floats via float bridges, and there is also on the West Side the freight line of the New York Central with two inland stations and numerous industrial sidings south of Sixtieth Street, together with other local facilities north of Sixtieth Street, in territory not reached by any other railroad. The four terminals of the New Jersey railroads lie between the marginal street and Eleventh Avenue, above Twenty-third Street. The Baltimore & Ohio has the block between Twenty-fifth and Twenty-sixth Streets, the Lehigh Valley has the adjoining block on the north, the Erie has that between Twenty-eighth and Twenty-ninth Streets, while the Pennsylvania has two blocks, from Thirty-seventh to Thirty-ninth Street.

These stations are operated to and from the float bridges by local switch engines. Each of them has team tracks and crane facilities for handling fairly heavy or bulky freight. All but the Lehigh Valley have local freight houses as well, while the Lehigh Valley operates Pier 66 and the Pennsylvania operates Piers 77 and 78 as parts of the inland stations. Space is necessarily limited in these terminals, and full utilization of it is accomplished by sharp curves, short switching leads and other obstacles to economical switching operations.

New York Central's West Side All-Rail Facilities

Aside from purely local facilities north of Sixtieth Street, the New York Central's facilities on the West Side consist of a combined break-up and waterfront yard extending from Seventy-second to Fifty-ninth Street; a double-track line in Eleventh Avenue to Thirty-third Street; a yard and terminal at the latter point, running across to Ninth Avenue and Thirtieth Street; a double-track line south in Tenth Avenue and West, Canal and Hudson Streets; and a terminal bounded by Hudson, Laight, Varick and Beach Streets, known as the St. Johns Park Terminal.

At the Sixtieth Street yard are classification tracks, a transfer platform, an engine terminal, four float bridges, five lighterage piers, a local freight station, a grain elevator and stock yards. The tracks are mostly curved, stub tracks, poorly arranged for efficient operation, aside from their inadequate length. There is no room for expansion south, and none north except by encroaching on Riverside Park or the Hudson River. Cars are floated between this yard and the New York Central pier stations, and also between it and the West Shore yard across the river at Weehawken.

The Thirty-third Street yard consists of classification tracks, a local freight station, team tracks, express terminal, milk station, three lighterage piers, and two float bridges not now used. In theory nothing but local switching is done here, trains for and from St. Johns Park being switched only at Sixtieth Street; but the plan cannot be wholly carried out because of the inadequacy of the Sixtieth Street yard. A large number of stub classification tracks cross Eleventh Avenue at grade, while at the east end of the yard the tracks converge and require switching across Tenth Avenue.

St. Johns Park Terminal consists of tracks, platforms and narrow driveways, all housed in a structure built in 1864, the two upper stories and basement of which are leased to a warehouse company. The age of the terminal is evidence enough of its obsolescence and inadequacy.

Between and in the upper two yards ordinary road and yard locomotives are allowed to operate at slow speed. South of Thirty-third Street only special boxed-in locomotives of small capacity are used.

Formerly the float bridges at Thirty-third Street were used to afford the West Shore access to the inland terminals of the New York Central, but now the Sixtieth Street bridges are used for the purpose.

In addition to the foregoing facilities, in territory reached by the New Jersey railroads, the New York Central has a milk station and other local service tracks at Manhattan Street (128th Street), a small freight house at Dyckman Street (200th Street) and a number

Interior of Three Adjoining Railroad Piers Operated as One Station, Devoted Principally to Food Products — Note Use of Trailers for Inbound Freight, Amount of Space Reserved for Driveways, and Heating System for Preservation of Perishables — Fruits and Vegetables Are Sold on These Piers, Contributing to the Congestion Normally Existing at the Station

of industrial tracks scattered between Sixtieth Street and Spuyten Duyvil. The New York Central has a virtual monopoly of this territory, but a considerable part of it is along park land where commercial development is not permissible.

Stations in Other Parts of New York City

Aside from the all-rail stations, mostly small, of the New York Central in upper Manhattan and the Bronx, of the New Haven in the Bronx, of the Long Island in Brooklyn and Queens and of the Baltimore & Ohio on Staten Island, those sections rely upon the same character of stations as lower Manhattan, pier stations and float-bridge terminals, together with another type of facility found mainly in Brooklyn and on Staten Island — the private terminal. The number and capacity of the stations in these other sections of the city are not commensurate with the commercial activity of those sections for the two primary reasons that a large part of their goods, particularly incoming foodstuffs, is trucked from or to stations in lower Manhattan, and that the private terminals handle a large volume of traffic.

Inland or Float-Bridge Terminal on Harlem River — Bridges for Transferring Cars, Driveways for Team-Track Freight and Gantry Cranes for Heavy Freight Characterize Such Terminals

HARLEM AND BRONX STATIONS

There are two pier stations on the upper East Side in the Harlem section of Manhattan, and on the north side of the Harlem River, in the Bronx, are three inland terminals. The Central Railroad of New Jersey operates one of the latter exclusively, the Lehigh Valley another, while the third is used jointly by the Lackawanna, the Erie and the Baltimore & Ohio, the Lackawanna owning it. The Lackawanna and Central of New Jersey terminals are east of the main line of the New York Central, in the vicinity of Third Avenue. The Lehigh Valley terminal is at 149th Street.

These terminals were laid out before the Bronx had attained its present development. They are in cramped locations, and are not economical to operate. A characteristic of them is the curved freight house, which was planned to give a maximum of track space, but which necessitates sharp curves, hampers the trucking operations and is far from ideal in operation.

TABLE 3 — LOCATION AND CONTROL OF PIER AND INLAND RAIL (FLOAT-BRIDGE) STATIONS IN BROOKLYN

Station	Pier number	Adjacent streets	Railroad operating
		Pier Stations	
Wallabout	2	Washington ave	Penna.
Wallabout	3	Washington ave	N. Y. C. and W. S.
Wallabout	4	Freeman ave	B. & O.
Wallabout	5	Freeman ave	L. V.
Wallabout	Clinton ave	Clinton and Freeman	Erie
		Inland Stations	
Wallabout		Kent ave., Cross st., Wallabout Canal and Channel	D., L. & W.
North 4th st		Kent ave. and North 4th and North 5th sts	Penna.
25th st		3rd ave. and 25th st	D., L. & W.

BROOKLYN, QUEENS AND STATEN ISLAND

In Brooklyn there are five pier stations and three inland stations, the ownership and location of which are shown in Table 3. All but two are in the Wallabout District.

None of the railroads have either pier stations or float-bridge terminals for direct service to Queens or Staten Island.

Private Terminals

There are twelve private terminals in the Port District, operated by eight companies. One of these, the Harlem Terminal, is not common to all railroads, and is used only by the Delaware, Lackawanna & Western, Erie and Baltimore & Ohio railroads. It is treated in this chapter under the head of inland terminals.

Characteristics of the other companies and their terminals follow.

NEW YORK DOCK COMPANY

The New York Dock Company occupies about two miles of Brooklyn waterfront, extending from Fulton Street to Wolcott Street; it has 32 piers and 148 warehouses. It operates three terminals, as follows:

Atlantic Terminal, located at the foot of King Street, Brooklyn. It is served by one float bridge and a marginal railroad, and offers track delivery for carload freight, warehouses for general merchandise and carload freight service for the following steamship lines docking at its piers:

Atlantic & Pacific Steamship Company
Union Clan Line
New York & South American Line
Clyde West India Line
New York & Porto Rico Steamship Company
Barber & Company's Lines
Houston Line
Trinidad Line
United States & Australasian Line

It also offers private siding services to various industries. It is served by car floats operated by the New York Dock Company.

Baltic Terminal, located at the foot of Baltic Street, Brooklyn. It is served by one float bridge and a marginal railroad, and offers house delivery for carload and less-than-carload freight, track delivery for carload freight, warehouses for general merchandise, and carload and less-than-carload deliveries for the following steamship lines docking at its piers:

National Steam Navigation Company
Bull Insular Line
Anchor Line
Sicula Americana Line

It also offers less-than-carload deliveries for steamship lines docking at Fulton or Atlantic Terminals and carload service on private sidings for various industries. It is served by car floats operated by the New York Dock Company.

Fulton Terminal, located at the foot of Montague Street, Brooklyn. It is served by two float bridges and a marginal railroad, and offers track delivery for carload freight, warehouses for general merchandise, private sidings for various industries and for the National Cold Storage Company, and carload service for the following steamship lines docking at its piers:

Booth Steamship Company
Lamport & Holt Line
Commonwealth & Dominion Line
Red "D" Line
New York & Cuba Mail Steamship Company

It also offers carload service for the following lines docking at general cargo piers:

National Navigation Company
New York & South American Line
West Coast Line to South America
United States & Australasia Steamship Company

It is served by car floats operated by the New York Dock Company.

BUSH TERMINAL

The Bush Terminal Company's plant in South Brooklyn extends from Twenty-eighth to Fifty-first Streets, all of its piers being south of Thirty-ninth Street. The company has eight piers, two modern loft buildings, 118 warehouses, a marginal railroad and yard, a float bridge, and direct connection with the Long Island Railroad at Fifty-eighth Street. It offers lofts for manufacturing purposes, house delivery for less-than-carload freight, track delivery for carload freight, private sidings for various industries, warehouses for general merchandise, carload and less-than-carload service for independent stores, and carload and less-than-carload service for the following steamship lines docking at its piers:

American & African Line
American & Australian Line
American Exporters
American & Indian Line
American & Mediterranean and Levant Lines
American & Manchurian Line
American & Rio Platte Line
American & Oriental Line
American, Asiatic Steamship Company
American & French Mediterranean Line
American & Hawaiian Steamship Company
Austro Americana Line
United States, China & Japan Line
Nippon Yusen Kaisha Line
Fabre Line
Uruguay & Argentine Line
India Line
Furness Line
Furness & Prince Line
American & India Line
Java & New York Line
Ocean Steamship Company
China Mutual Steam Navigation Company
Brasil Service Line (Funch Edye & Company)
Russian Transport Line
Russia-American Line
Cunard Rotterdam Service
Lloyd Brasilieiro Steamship Company
Lloyd Italiano Line
Norton Line
Prince Line
Royal Dutch West India Mail
United States Shipping Board's Greek and Adriatic Lines

It is served by its car-float equipment and furnishes also over the Bush Terminal Railroad track deliveries for carload freight at the Twenty-eighth Street station, house deliveries for less-than-carload freight and track deliveries for carload freight at the Thirty-sixth Street station, house deliveries for less-than-carload freight and track deliveries for carload freight at the Forty-eighth Street station, and track deliveries for carload freight at the Fifty-third Street and Sixty-third Street stations.

JAY STREET TERMINAL

The Jay Street Terminal, operated by Arbuckle Brothers, occupies the Brooklyn waterfront from Gold Street to New Dock Street. It has nine piers, ten warehouses, a railroad and a float bridge. It offers house delivery for carload and less-than-carload freight, track delivery for carload freight, warehouses for general merchandise, and sidings for various private industries. It operates its own marine equipment.

BROOKLYN EASTERN DISTRICT TERMINAL COMPANY

The Brooklyn Eastern District Terminal Company operates four private terminals as follows:

Brooklyn Eastern District Terminal, in Brooklyn, from North Third to North Tenth Street. It has seven piers, public warehouses, four float bridges and a marginal railroad. It offers house deliveries for carload and less-than-carload freight, track deliveries for carload freight, a warehouse for the storage of hay and straw, warehouses for general merchandise, a grain elevator of 500,000 bushels capacity and private sidings for industrial concerns. It is served by car floats operated by the Brooklyn Eastern District Terminal Company.

Pidgeon Street Terminal, at the foot of Pidgeon Street, Long Island City, just north of Newtown Creek, consisting of a float bridge and a railroad yard. It offers only track delivery for carload freight. It is served by car floats operated by the Brooklyn Eastern District Terminal Company.

Queens Borough Terminal, at the foot of Fourteenth Street, Long Island City. It has one pier, no rail service or float bridge, no warehouses. Carload and less-than-carload freight deliveries are made from car floats or lighters tied up alongside a pier. It is served by car floats operated by the Brooklyn Eastern District Terminal Company.

Warren Street Terminal, in Jersey City, on the north side of the Morris Canal Basin. It has a float bridge and a railroad yard, and offers house deliveries for carload and less-than-carload freight, track deliveries for carload freight, and warehouses for general merchandise. It is served by car floats from all railroads and car floats operated by the Brooklyn Eastern District Terminal Company.

AMERICAN DOCK COMPANY

The American Dock Company is located at the foot of Arrietta Street, Tompkinsville, Staten Island. It has five piers, thirty-six warehouses and rail service from the Baltimore & Ohio Railroad. It has the following tenants at its piers:

Union Wharf Company
Norton, Lilly & Company
Oriental Operating Company

It is used by all railroads, but maintains no car-float or lighterage service.

POUCH TERMINAL

The Pouch Terminal is operated by the Pouch Terminal Company and is located at Clifton, Staten Island. It has rail service from the Baltimore & Ohio Railroad, three piers and fifteen warehouses, but no float bridges. It is used by all railroads, but maintains no car float or lighterage service. The following companies are tenants at its piers:

Oriental Navigation
Nippon Yusen Kaisha
Livermore Dearborn & Company

Lighterage

Sixty-five per cent of all freight, exclusive of interchange, handled by the railroads of the Port District is lightered. Much of it is destined for or received from ships, and is transferred in suitable harbor craft direct from the lighterage pier to the ship or its pier, or in the reverse direction. Still more of it, so far as the railroad records show, is goods consumed or produced within the Port, although it is evident that a large amount of goods so indicated in the records is merely stopped at the Port for resale, storage or other purpose on its way to or from coastwise or transoceanic ships.

For goods originating at or destined for rail points beyond an imaginary line surrounding the Port a few hundred miles from it the rate usually provides free lighterage, which means that the carrier will deliver inbound goods without extra charge to any waterfront point within lighterage limits, or receive them at any waterfront point within those limits. The limits, which have been changed from time to time, extend at present to about 150th Street on the Hudson River, to High Bridge on the Harlem River, to Astoria on the Long Island shore of the East River, including all of Newtown Creek and the Gowanus Canal, to the Narrows on the south and to Port Richmond on Kill von Kull.

Lighterage is performed either by the railroad companies or by private companies, of which there are probably eighty. The service reaches steamship piers, Barge Canal terminals, public or semi-public piers, and private piers of industrial plants.

There is no standard type of vessel used in lighterage service. The craft (see Chapter 27, page 393) range from simple scows with no form of power to self-propelled derrick boats able to transfer their own loads to and from decks. This lack of uniformity of design is necessary when we consider the many different kinds of commodities handled by lighters, and the great variety of service performed. Package goods may be trucked from pier to lighter or from lighter to pier, and they may also be trucked over the gang plank between lighter and side-port ship. Machinery may be available at some private piers for unloading heavy pieces, while at others there is no machinery, and the lighter itself must be equipped to effect the transfer. Transfer between lighters and ships' hatches in the foreign trade may be accomplished by ships' gear, but again a considerable percentage of such foreign cargo is brought to the pier and unloaded upon it before the arrival of the ship, or taken away by the lighter after the ship departs.

Group of Covered Lighterage Piers at Waterfront Yard — Tracks Inside Sheds

Double-Shedded Lighterage Pier at Waterfront Yard — Tracks Between Sheds

Whatever improvements may be made in the way of better designed piers, modern machinery on them or rail access to them, it can be taken for granted that the sheltered waters of the harbor will remain a natural means of intercommunication between different parts of the Port, and the demand for the lighter in its many forms will continue.

Special Facilities

There are some six or eight commodities handled by the railroads in sufficiently large quantities to warrant special facilities or special treatment of some sort. They consist of grain, coal, perishable food, live stock, milk and ores.

In the case of perishable food it is a question of methods rather than facilities. The methods are in part caused by and in part the cause of the general market system for the Port. The principal operations have already been described, the floating of fruit and produce to pier stations on the lower West Side of Manhattan and their sale and delivery therefrom. Not all of the fruit and produce comes to Manhattan in this way, although a large percentage of that consumed at the Port does come in some manner to the primary market on the lower West Side. Produce shipped in by rail from southern New Jersey and other comparatively near points is in general unloaded at team tracks at the New Jersey waterfront terminals and trucked by ferry to the primary market. Dressed meat is handled largely by a small number of packers who have establishments at various points throughout the Port, and a smaller percentage of this food passes through the primary market. A large part of the poultry brought in by the railroads is delivered to the poultry yard of the Lackawanna at Hoboken and thence trucked over to a special poultry market at West Washington Market. Fish comes to the Port largely by express and the Sound steamers and is handled differently from any other product, through the general fish market at Fulton Street and the East River.

The handling of perishable and other foodstuffs is discussed at considerable length in Chapter 20, as are suggested improvements in the present methods and the general market system.

Coal and grain, both of which are handled by the railroads in large quantities, mainly inbound, both require facilities of a special nature. The existing facilities and the recommended changes are discussed at considerable length in Chapters 28 and 29 respectively. Suffice it to say here that the grain movement is not so great but that the grain cars are ordinarily brought through the break-up yard just as is general freight, and that the elevator or other terminal facilities (a trestle in the case of the Lackawanna) are located in the waterfront yards, with certain tracks to serve them; whereas the coal movement is so great as to warrant hauling full trainloads of coal which may either be switched over separate humps in the break-up yards, as in the case of the Lackawana, or turned off to separate coal terminals from junctions beyond the break-up yards, as in the case of the Erie, the Pennsylvania and the Lehigh Valley.

In the case of the grain, whereas much of it is locally consumed, much of it is also exported, the transshipment being in part direct from elevator to ship alongside but in a greater part by means of barges and floating elevators. In the case of the coal, much of it is locally consumed, delivered either by truck or by lighter, much is transferred to barges and towed through Long Island Sound to New England points, much is transferred by lighter to the bunkers of ships in port at their berths, while very little is exported. Some of the coal is transferred at the railheads by means of elevated trestles from which the cars can unload into bunkers or discharge into vessels, and a larger part by the more modern car dumpers, of which several have been built within the last ten years.

Railroad Interchange

Fig. 17 of this chapter shows the extent to which the twelve principal railroads of the Port interchange freight with each other. The greatest single movement is between the Pennsylvania and the New York, New Haven & Hartford Railroad, this movement constituting a large percentage of the New Haven's total tonnage within the Port. It, like interchange between the New Haven and all the other New Jersey railroads, is effected by means of car floats, the floats in general being larger than those in the pier-station service, with a third track in place of the covered platform to permit the transfer of a maximum of cars.

Interchange between the New York Central and the New Jersey railroads, which is much smaller in volume, is also accomplished by means of car floats. Even where there is physical rail connection between the railroads, as between all of the New Jersey railroads, and between the New York Central and the Long Island, floating is resorted to in large measure because the connecting links are owned by individual railroads, and not available for all.

IV — TONNAGES

Following are data relating to the study of total tonnages in the Port District for one year, and others pertaining to the more minute study of tonnages, car movements and the trend of traffic at the Manhattan freight stations. The figures derived in the third and fourth general groups of tonnage and car-movement studies, those used in the cost analysis for the month of July, 1914, and those applied to the clocking studies of 1918, are in the records of the Commission, but are regarded merely as working figures and are not presented in this report.

In 1914 the twelve railroads of the Port handled 76,052,000 tons of freight into, out of or through the Port District, in addition to the amounts, not determined, delivered at or despatched from points in the District beyond the break-up yards and not handled through those yards. Of this tonnage 53,359,000 tons were inbound, 9,756,000 tons outbound and 12,937,000 tons through or interchange, the proportions being shown graphically by Fig. 1.

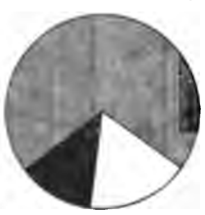


Fig. 1 — Proportions of 1914 Railroad Tonnage

Grey, inbound
Black, outbound
White, interchange

Fig. 2 shows in another manner the total tonnage represented by the full circle of Fig. 1, and Figs. 3–7, all drawn to the same scale, subdivide in various ways all but the interchange tonnage. Fig. 3 shows the great preponderance of inbound traffic, due largely, as Fig. 6 indicates, to the large excess of movement inbound of grain, other foodstuffs and fuel either consumed within the Port District or taken away by water. The captions of Figs. 4–7 are self-explanatory. The reasons for the various groupings will be developed in the succeeding paragraphs relating to the details.

Salient facts brought out by these diagrams are the wide distribution of the tonnage of the Port, the great percentage of floating as compared with all-rail terminal operations, the magnitude of the coal traffic of the New Jersey railroads.

Distribution of Traffic, and Methods Employed

Table 4 is the basis for Figs. 1 and 7. It shows that exclusive of the through or interchange traffic the nine New Jersey railroads brought to the Port nearly twenty times as much freight as the three New York railroads did, while they took from it nearly five times as much.

Table 4 — Railroad Tonnages in 1914 by Railroad Groups and Direction of Flow

	Tonnage		
	Inbound	Outbound	Total
New Jersey	50,367,000	8,006,000	58,373,000
New York	2,992,000	1,750,000	4,742,000
Total	53,359,000	9,756,000	63,115,000
Interchange			12,937,000
Grand total			76,052,000

Table 5 — Railroad Tonnages in 1914, Excluding Interchange, by Geographical Divisions

Geographical division	New Jersey railroads	New York railroads	Total
The Bronx	321,000	938,000	1,259,000
Manhattan	17,884,000	2,908,000	20,792,000
Long Island	11,667,000	391,000	12,058,000
New Jersey and Staten Island	14,764,000	47,000	14,811,000
Coastwise shipping	7,616,000	198,000	7,814,000
Export and import	6,121,000	260,000	6,381,000
Total	58,373,000	4,742,000	63,115,000

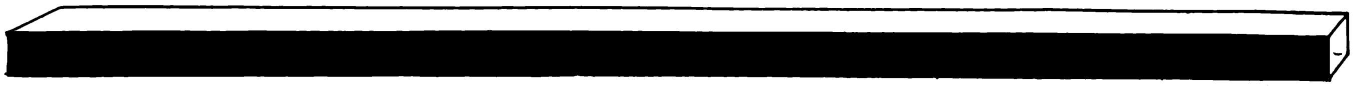


FIG. 2 — Total Railroad Tonnage, Including Interchange, Entering and Leaving Port of New York in 1914

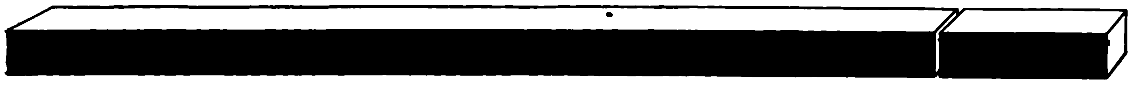


FIG. 3 — Total Inbound and Outbound

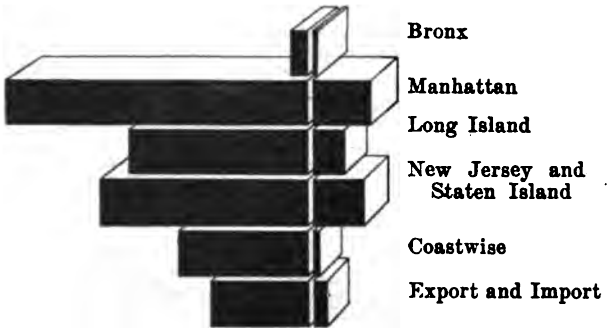


FIG. 4 — By Geographical Divisions

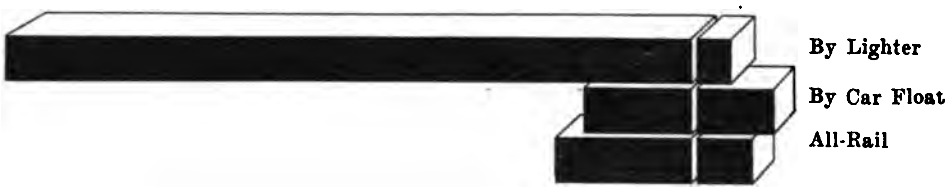


FIG. 5 — Methods of Local Movement

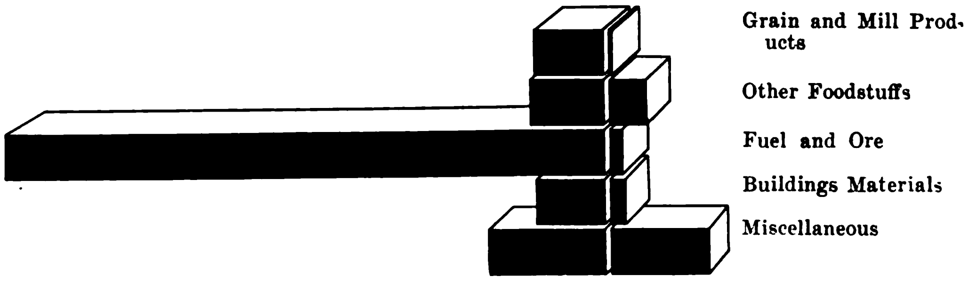


FIG. 6 — By Commodity Groups

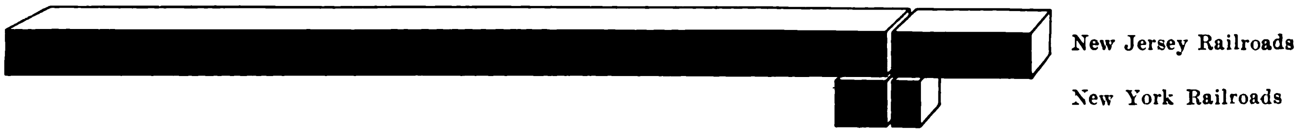


FIG. 7 — By Railroad Groups

FIGS. 3-7 — 1914 Railroad Tonnages, Excluding Interchange, Subdivided Various Ways — Inbound on Left, Outbound on Right

This is striking evidence of the dependence of New York upon the New Jersey railroads and the need for a unified port.

The table also shows that more than one-sixth of the railroad tonnage of the Port was through traffic, from which the Port derives no benefit.

Table 5 is the basis for Fig. 4, the data being subdivided between the New Jersey railroads and the New York railroads. These figures must be taken with certain reservations. The journey of a ton of freight is not necessarily ended when the railroad makes delivery, for goods destined for any other borough of New York City may be delivered in Manhattan and recorded as Manhattan freight, while goods for Manhattan may be delivered in New Jersey and so recorded. This makes it impossible to separate New Jersey and

Staten Island, as nearly all Staten Island freight appears in the carriers' records as New Jersey or Manhattan freight. All-rail and car-float operations are separable between Manhattan and the Bronx, but lighterage operations are not, which fact accounts in the main for the seemingly small proportions of the Bronx tonnage. Queens tonnage is also inseparable from Brooklyn tonnage, so that the single figure for Long Island tonnage is given.

Much of the freight destined for transshipment at the Port between cars and either coastwise or transoceanic ships can be identified as coastwise export or import shipping and is so recorded in the table. The location of the ships in the Port does not appear in the records, hence no attempt is made at a geographical subdivision of this shipping, and no figures have been obtained as to the relative transshipment operations in Manhattan, Brooklyn and New Jersey. On the other hand, those figures for coastwise shipping and for exports and imports by no means constitute the full quantity of goods brought by the railroads and ultimately loaded upon ships or brought by ships and ultimately despatched in cars, for the reason that a considerable volume of the tonnage ascribed to Manhattan and other geographical divisions of the Port was unquestionably merely reconsigned and not consumed or produced within the Port.

Electrically Operated Pontoonless Bridges for Transferring Cars From Uplands to Car Floats

With these limitations the table is of value as showing a large volume of tonnage in each group.

Table 6 shows in a striking manner the relative proportions of freight moved within the Port District by the three basic methods — by rail exclusively, by car float or by lighter. It is the basis for Fig. 5.

Virtually 70 per cent of the traffic handled by the New Jersey railroads was lightered, this including both coarse freight and heavy pieces originating in New York or destined for use in the Port, and goods transferred between cars and ships either direct at steamship piers served by tracks or by lighter transfer. About the same quantities were handled by car float as entirely by rail.

Table 6 — Railroad Tonnages in 1914, Excluding Interchange, by Methods of Local Movement

	New Jersey railroads		New York railroads		Total	
	Tons	Per cent	Tons	Per cent	Tons	Per cent
All-rail......	8,642,000	14.8	2,409,000	50.8	11,051,000	17.5
Car float.....	9,002,000	15.4	1,802,000	38.0	10,804,000	17.1
Lighter......	40,729,000	69.8	531,000	11.2	41,260,000	65.4
Total....	58,373,000	100.0	4,742,000	100.0	63,115,000	100.0

In the case of the three New York railroads the percentage of lighterage is small because the New York Central handles most of its export business via the West Shore at Weehawken, and the Long Island has little lighterage. The effect of this difference in percentage on the totals for the Port is small, and we still find 65 per cent of the Port's railroad traffic transferred by lighter.

The data in Tables 4, 5 and 6 together with other information in the records of the Commission relative to the individual railroads have been combined in the two parts of Fig. 8 showing inbound and outbound traffic separately. In this chart and succeeding charts the areas of the circles represent, in the same scale as in Fig. 1 of this chapter, the tonnages received or delivered at the specified point, in the specified division or by the specified railroads or groups of railroads, while the areas of the bars connecting them (determined in most cases by their length) represent the volume of traffic moving from one circle to the other.

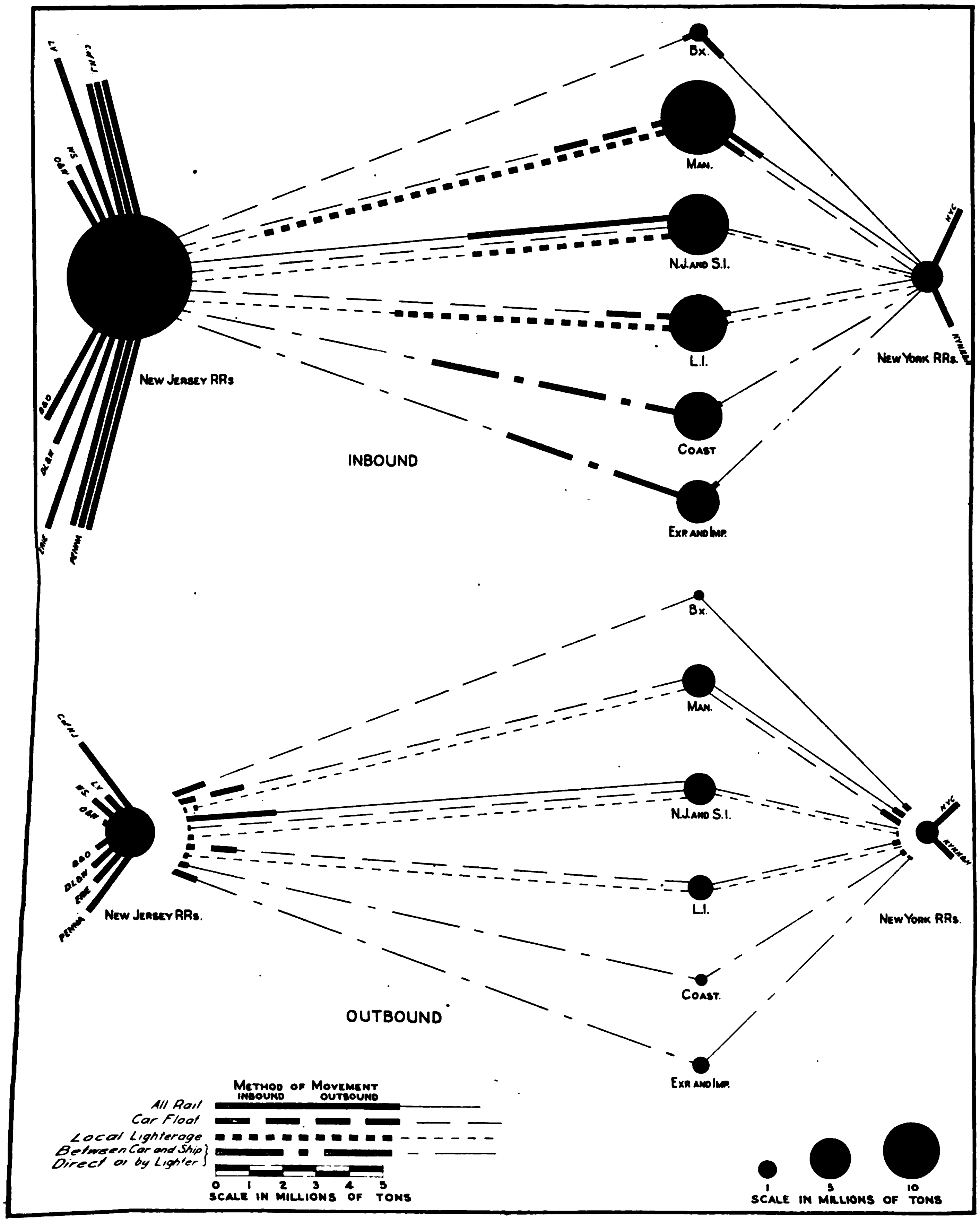


FIG. 8 — 1914 Tonnages In and Out at Port of New York, by Railroads. Geographical Divisions and Methods of Local Movement

Figs. 9–11 show separately the lighterage movement, car-float movement and all-rail movement by railroad groups and geographical divisions. Fig. 9 shows no separation between Manhattan and the Bronx, because of the impossibility as already explained of making such separation. Fig. 10 shows the separation not only between Manhattan and the Bronx but between the Hudson River and East River waterfront of Manhattan. It was necessary to study the car-float movement more minutely than the other classes to work out the

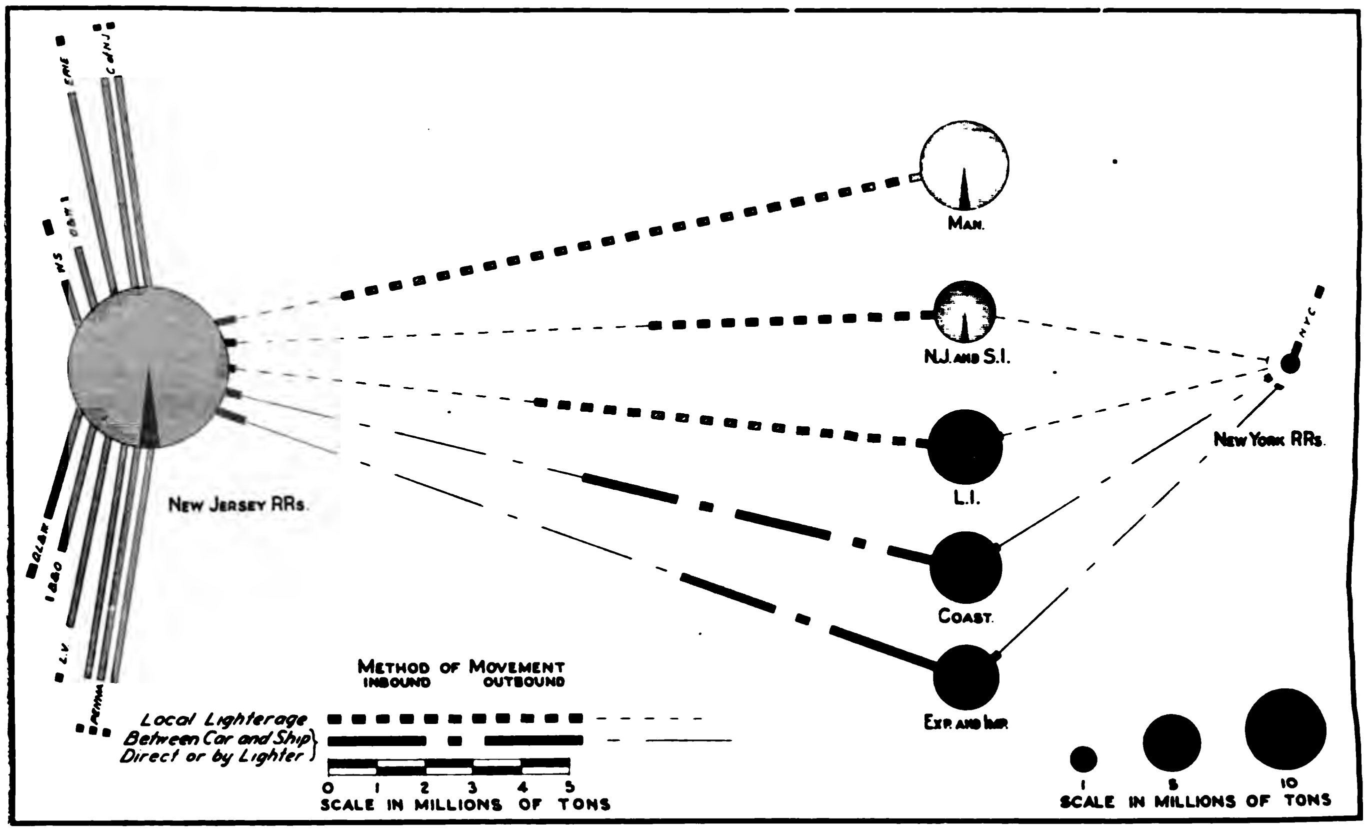


FIG. 9— 1914 Railroad Tonnages Handled Locally by Lighter. Inbound and Outbound, by Geographical Divisions

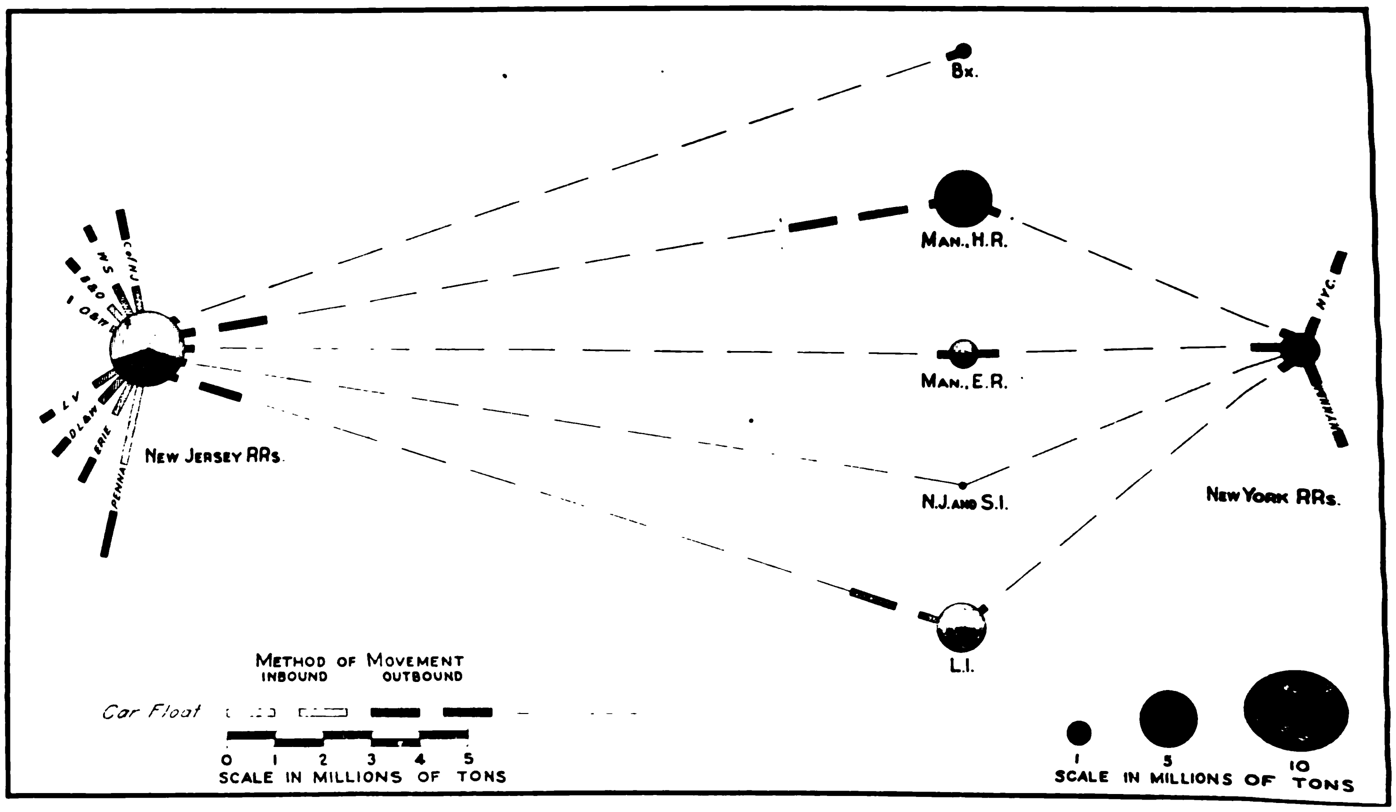


FIG. 10 — 1914 Railroad Tonnages Handled Locally by Car Float, Inbound and Outbound, by Geographical Divisions

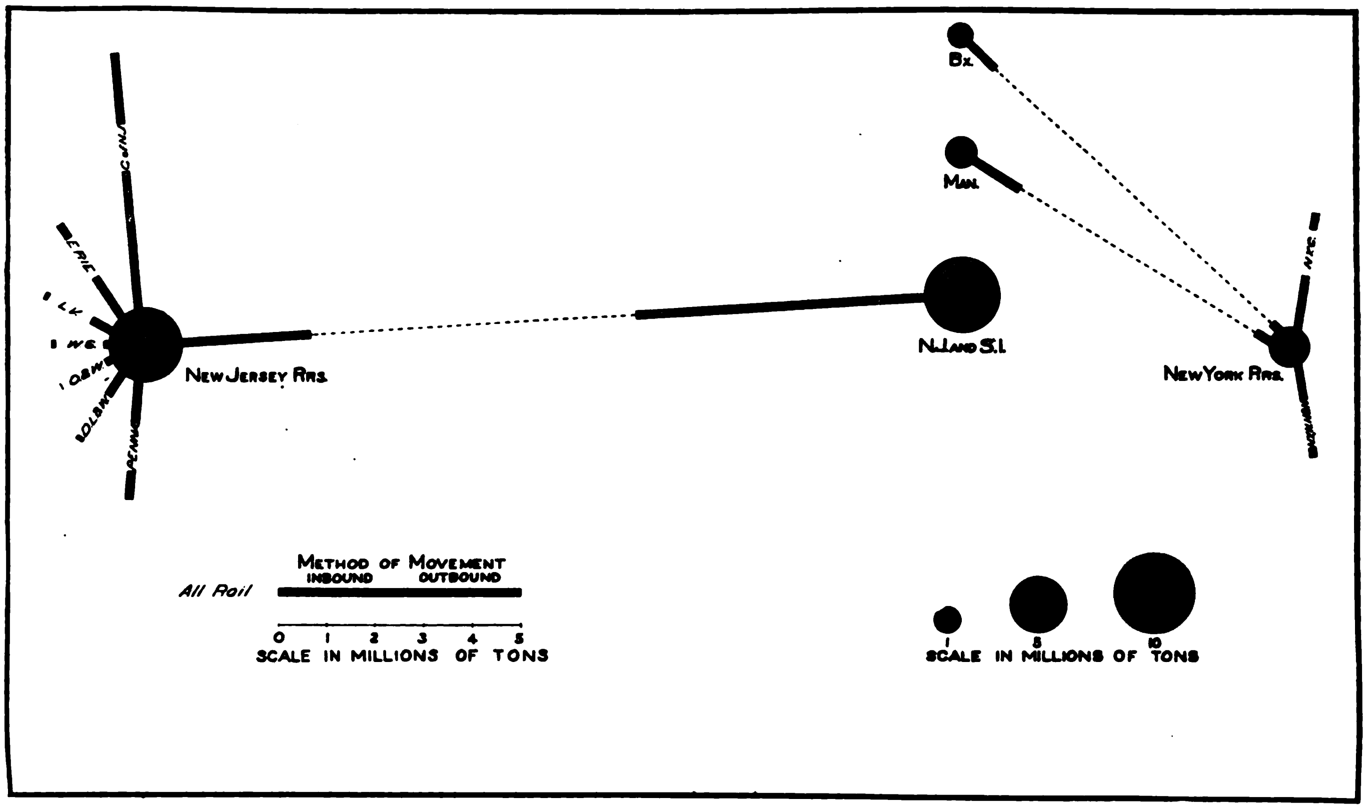


FIG. 11 — 1914 Railroad Tonnages Handled Locally Entirely by Rail, Inbound and Outbound, by Geographical Divisions

details of the automatic-electric system, and Figs. 18–30 carry the study much farther.

Fig. 11 of course shows the complete separation between the New Jersey roads and the New York roads for all-rail movement.

COMMODITY CLASSIFICATION

Interstate Commerce Commission rules divide commodities into some thirty-eight classes, grouping them again according to their origin as products of agriculture, products of mines and so forth. For the purposes of this investigation it was thought desirable to make some consolidation of the classes, reducing the number to twenty-six. The majority of the twenty-six classes coincide with those similarly designated by the Interstate Commerce Commission, but a few of them combine two or more of the Interstate Commerce Commission classes; for example, "flour and other mill products."

Instead of the seven groups of the Interstate Commerce Commission based on the origin of make-up of the major part of the commodity, it was thought desirable to use five groups based on the use of the commodity or the general method of handling. The classes and groups are shown in Table 7, the groups being the same as shown in Fig. 6.

Float-Bridge Terminal in Manhattan — Freight House Also Serves as Warehouse

It may be wondered why there is no group designated manufactures, and why two classes, "manufactures" and "other manufactures," are in different groups. The reason is that a segregation of these two items into one group as designated by the records of the railroads would be entirely misleading. Mill products are manufactures, as are lumber, cement, sugar and many nonperishable food products. Merchandise as defined by the Interstate Commerce Commission is largely manufactured goods, and so are the majority of

TABLE 7 — CLASSES AND GROUPS OF COMMODITIES FOR GENERAL CHARTS

Grain and mill products	Grain
	Flour and other mill products
	Hay and straw
Other foodstuffs	Fruits and vegetables
	Live stock
	Dressed meats
	Live poultry
	Dressed poultry and game
	Milk
	Dairy products
	Non-perishable food products
	Sugar
Fuel and ore	Anthracite coal
	Bituminous coal
	Coke
	Ores
	Petroleum and other oils
Building materials	Lumber
	Other building materials
	Manufactures (heavy iron, steel, etc.)
Miscellaneous	Tobacco
	Cotton
	Wool, hides and leather
	Other manufactures
	Merchandise
	Miscellaneous

the myriad of items classified under miscellaneous. There are thus manufactures scattered throughout the list, and the sum of the two items, "manufactures" and "other manufactures," would fall far short of the total of manufactures brought to and taken from the Port by the railroads. There is no way of arriving at the correct total, and no attempt is made to show it.

Apart from these five commodity groups which are shown in the general commodity charts and tables, there are certain more limited groups which require special facilities or methods of handling. The Commission presents charts relative to six of these special groups built up as shown in Table 8.

Table 9 shows the subdivision of the 1914 tonnage, excluding interchange, into the five general commodity groups, subdivided by railroad groups and by direction of movement. It is an amplification of Figs. 6 and 7.

This Table shows, as does Fig. 6, the great amount of coal brought to the Port by rail despite the fact that very little coal is exported from the Port. The fuel and ore traffic (and the bulk of it is coal) constituted in 1914 nearly two-thirds of the inbound movement, and is responsible in the main for the unbalanced traffic, as the outbound movement was barely 2 per cent of the inbound. Grain also, while not handled at the Port in any such volume as coal, is almost entirely inbound. Foodstuffs and building material predominate inbound, but a considerable amount of foodstuffs move, outbound for the reason that New York is a primary distribution center for a large area.

Carrying the analysis still farther, to show its geographical distribution, we have Fig. 12, which has been developed in the same manner and to the same scale as Fig. 8. This chart brings out among other things the fact that a large percentage of the foodstuffs arriving at the Port are delivered in Manhattan; but the percentage is still greater because of the undeterminable amount of milk, produce and other foodstuffs unloaded in New Jersey and immediately trucked to Manhattan, either to the primary market in the case of produce or to distributing stations in the case of milk. Further light on the methods of local distribution and collection of the various kinds of commodities is shed by Table 10, the caption of which is self-explanatory. This table shows that most of the fuel and most of the grain is lightered, and that car-floating operations are resorted to mainly for the moving of foodstuffs (other than grain) and miscellaneous freight, which includes general package freight.

TABLE 8 — COMMODITY GROUPS BASED ON SPECIAL HANDLING FACILITIES

Group	Class
Grain	Grain
Perishable foodstuffs	Fruits and vegetables
	Dressed meats
	Dressed poultry and game
	Dairy products
Livestock	Live stock
	Live poultry
Milk	Milk
Coal and coke	Anthracite coal
	Bituminous coal
	Coke
Ores	Ores

Fig. 13 shows the movement by railroads, excluding interchange, of the six special commodity groups listed in Table 8. It reflects in some measure the specialization of different railroads in different commodities. The Pennsylvania, for example, brought in more coal than any other road, and more perishable foodstuffs, but very little grain. The Lehigh Valley brought more grain than any other road, but little perishable food, and less coal and coke than several other roads. The New York Central and West Shore brought virtually no coal, although the West Shore's tenant, the New York, Ontario & Western, brought a considerable

TABLE 9 — RAILROAD TONNAGES IN 1914, EXCLUDING INTERCHANGE, BY COMMODITY GROUPS, RAILROAD GROUPS AND DIRECTIONS OF FLOW

	New Jersey railroads		New York railroads		All railroads		
Commodity group	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Total
Grain and mill products	3,801,000	181,000	214,000	48,000	4,015,000	229,000	4,244,000
Other foodstuffs	3,071,000	1,714,000	1,210,000	447,000	4,281,000	2,161,000	6,442,000
Fuel and ore	34,329,000	667,000	16,000	89,000	34,345,000	756,000	35,101,000
Building materials	3,578,000	685,000	393,000	209,000	3,971,000	894,000	4,865,000
Miscellaneous	5,588,000	4,759,000	1,159,000	957,000	6,747,000	5,716,000	12,463,000
Total	50,367,000	8,006,000	2,992,000	1,750,000	53,359,000	9,756,000	63,115,000

TABLE 10 — RAILROAD TONNAGES IN 1914, EXCLUDING INTERCHANGE, BY COMMODITY GROUPS AND METHODS OF LOCAL MOVEMENT

	All-rail		Car float		Lighter		Total	
	Tons	Per cent of commodity	Tons	Per cent of commodity	Tons	Per cent of commodity	Tons	Per cent of commodity
Grain and mill products	419,000	9.9	593,000	14.0	3,232,000	76.1	4,244,000	100.0
Other foodstuffs	2,533,000	39.3	2,714,000	42.1	1,195,000	18.6	6,442,000	100.0
Fuel and ores	2,630,000	7.5	568,000	1.6	31,903,000	90.9	35,101,000	100.0
Building materials	1,713,000	35.2	829,000	17.0	2,323,000	47.8	4,865,000	100.0
Miscellaneous	3,756,000	30.1	6,100,000	49.0	2,607,000	20.9	12,463,000	100.0
	11,051,000	17.5	10,804,000	17.1	41,260,000	65.4	63,115,000	100.0

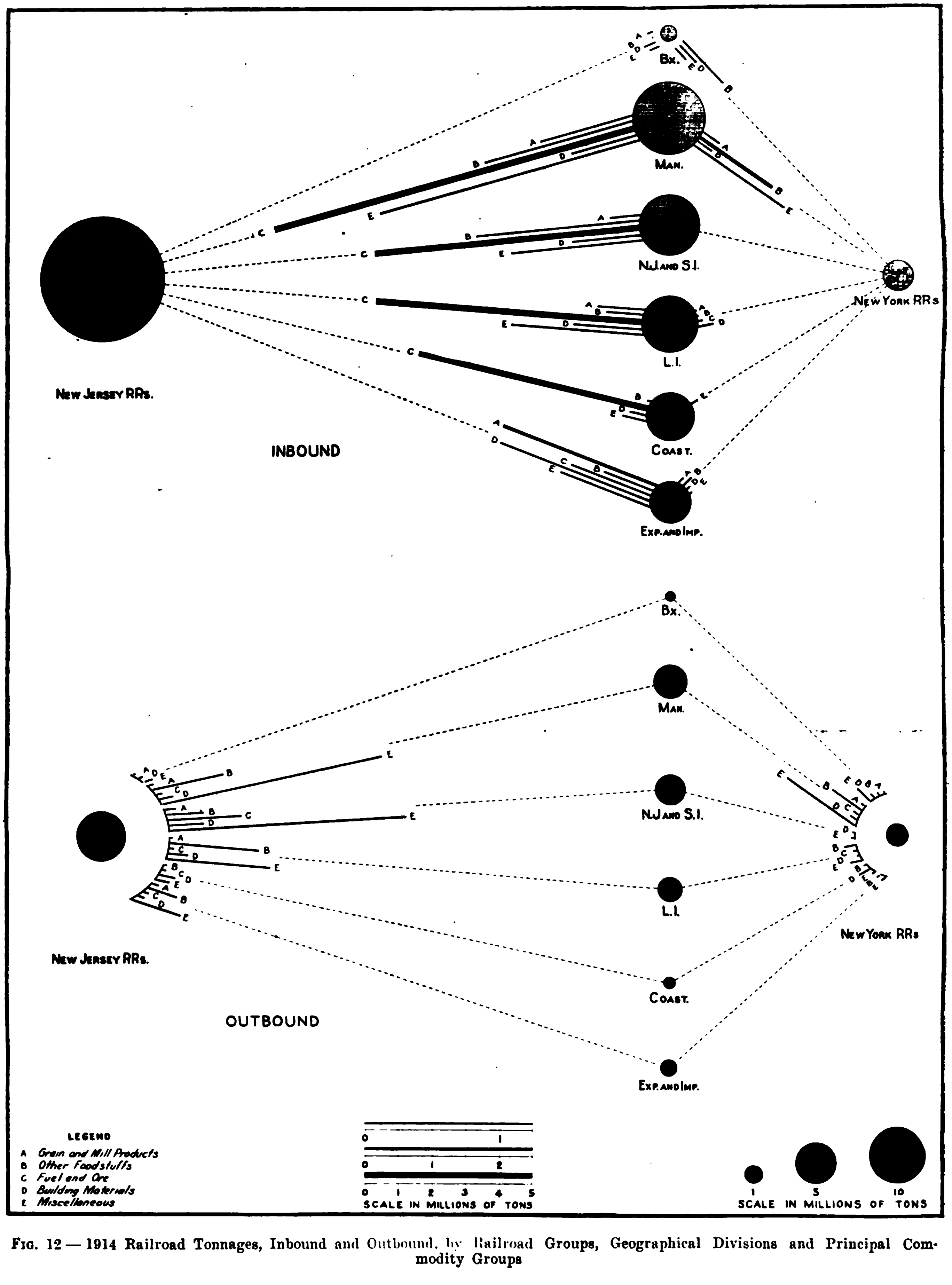


FIG. 12 — 1914 Railroad Tonnages, Inbound and Outbound, by Railroad Groups, Geographical Divisions and Principal Commodity Groups

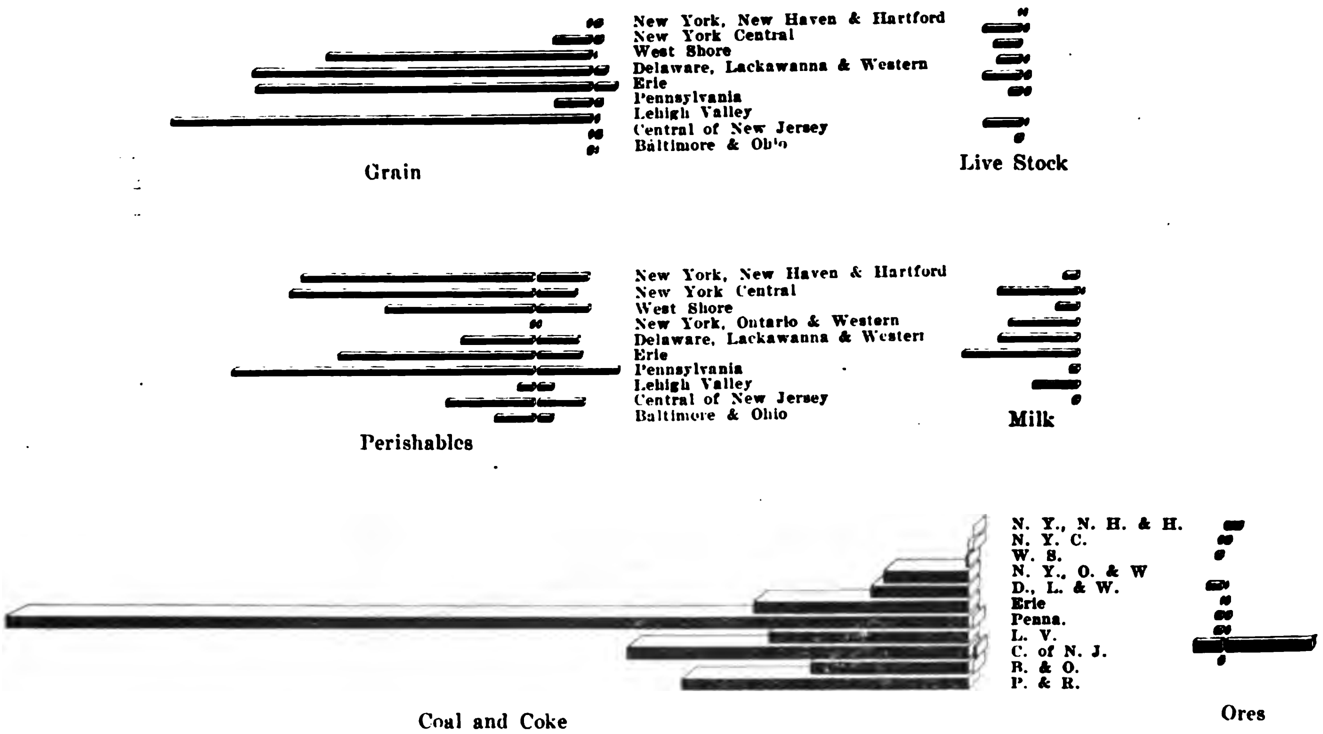


FIG. 13 — 1914 Railroad Tonnages, Inbound (on Left) and Outbound (on Right) of Six Special Commodity Groups

amount. The Ontario & Western brought more milk than the West Shore, but almost nothing in the perishable-foodstuff group. The Central of New Jersey handled nearly all of the ore handled at the Port, and most of it was outbound — tailings received by barge from the upper Hudson River. The Philadelphia & Reading appears only under the heading of coal and coke.

All of these special commodities except ores are preponderatingly inbound, and little can be deduced from the outbound sections of the diagrams other than that fact. Comparison of the individual railroads

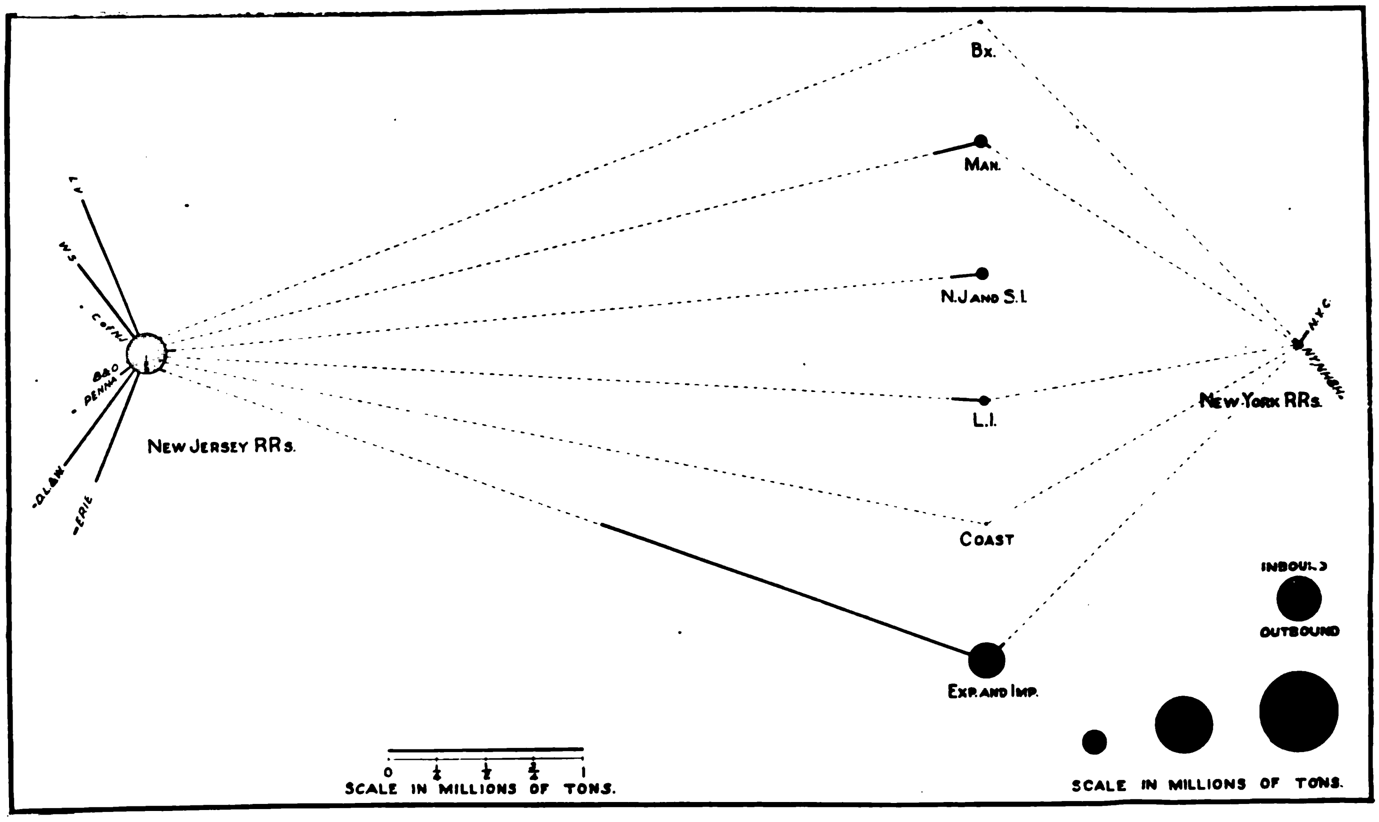


FIG. 14 — Distribution of Geographical Divisions of 1914 Railroad Movement, Inbound and Outbound, of Grain

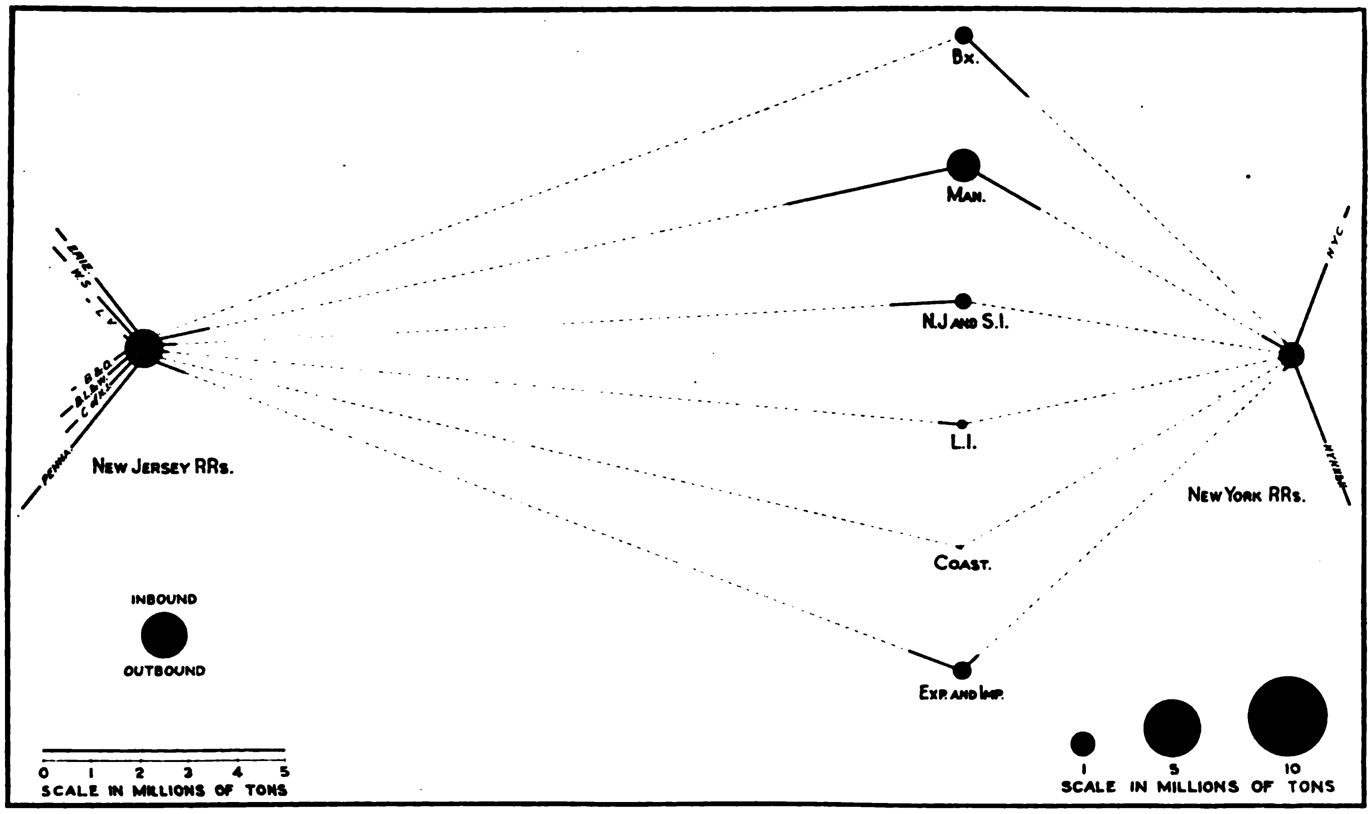


Fig. 15 — Distribution by Geographical Divisions of 1914 Railroad Movement Inbound and Outbound of Perishable Foodstuffs

should not be made too minutely with respect to either inbound or outbound freight, for the reason that the diagrams are based on one year, and the fluctuations are not uniform as between railroads.

Three of the commodity groups — grain, perishable foodstuffs and coal and coke — can be shown by geographical divisions and are so shown in Figs. 14–16, which are comparable with and drawn to the same scale

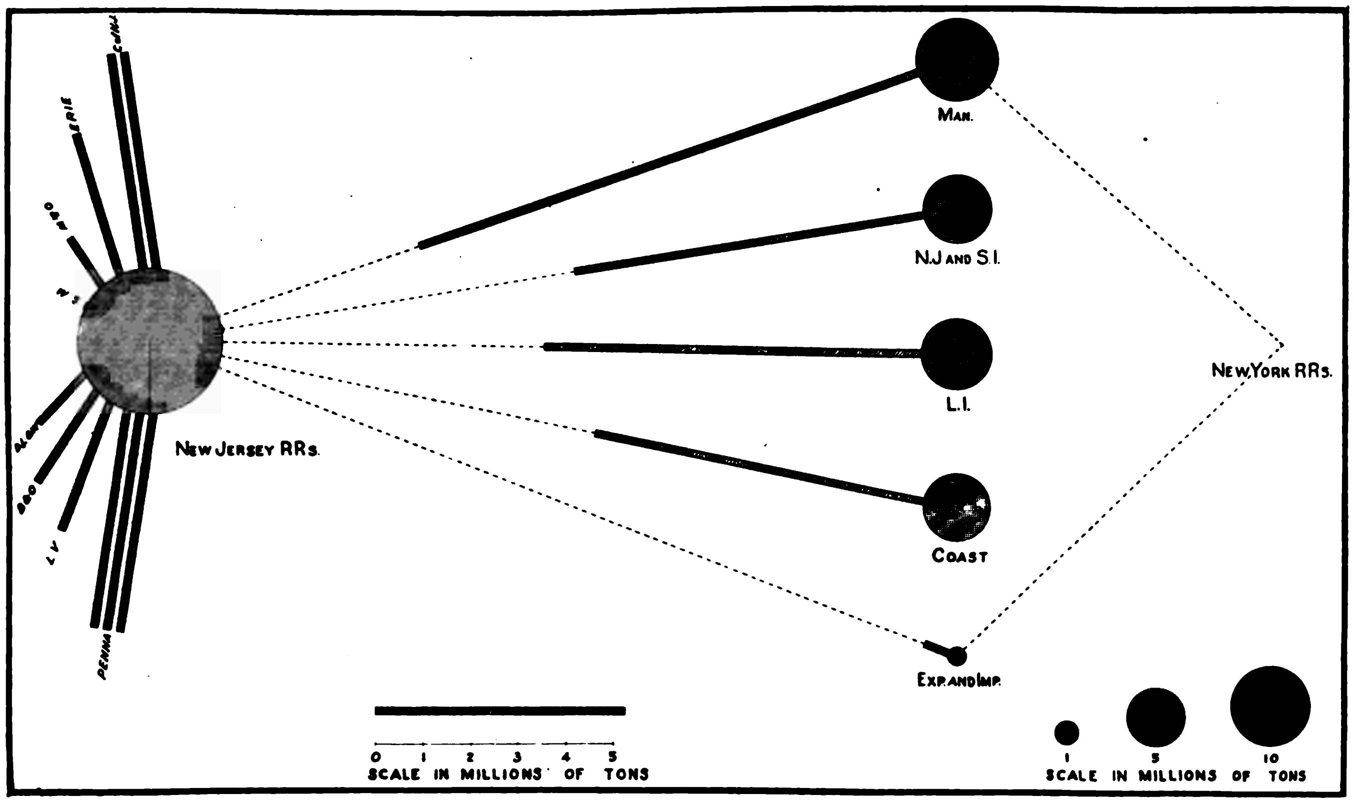


Fig. 16 — Distribution by Geographical Subdivisions of 1914 Railroad Movement Inbound and Outbound of Coal and Coke

as other charts of the same general form. No attempt is made to show the method of local movement.

The other three special commodity groups, all requiring special treatment, cannot be satisfactorily charted in this manner. Milk is delivered at the car to the milk companies, and while a large part of that brought in by the New Jersey railroads is trucked to and consumed in Manhattan and other boroughs of New York, it does not so show in the carriers' records. Live stock is also delivered in the main at the railroad car, and whether it is slaughtered on the New Jersey side or floated to New York slaughter houses, the water movement is not entered into by the railroads and does not show in their records.

Three-Track Car Float — Used Principally for Railroad Interchange

RAILROAD INTERCHANGE

The figure of 12,937,000 tons indicated in one of the sectors of Fig. 1 represents interchange between almost every railroad of the Port with almost every other one, Philadelphia & Reading tonnage being included in the Central of New Jersey tonnage. Fig. 17 shows the conditions found in the special study made by the statistical department. It shows the amount moved from each road to each other road and the method of movement, whether by rail or by car float. All of the movement involving a crossing of the Hudson River or Upper Bay was of course by car float. Much of that between the New Jersey railroads that could physically have been accomplished by rail was also by car float; for example, that between the Erie and the Central of New Jersey. The West Shore interchanged with the Central of New Jersey and the Lehigh Valley both by rail and by car float, utilizing the New Jersey Junction and the National Docks Railway for that purpose, but these belt lines were not available for interchange between the Erie and the Central of New Jersey.

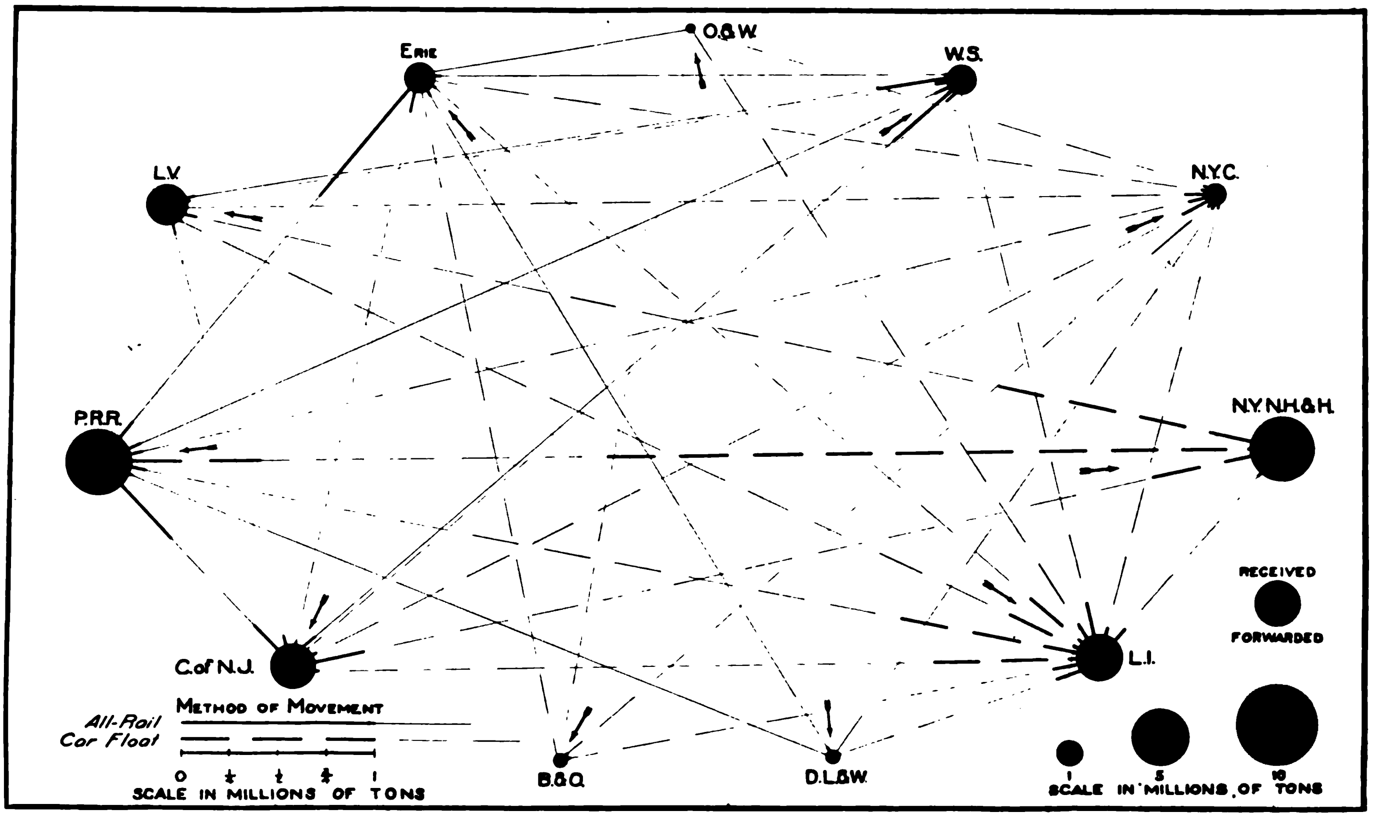


FIG. 17 1914 Railroad Interchange, by Railroads, by Direction and by Methods of Local Movement

Structural Steel Yard in New Jersey Where Members for Manhattan's Skyscrapers Are Received, Sorted and Held for Delivery in the Sequence Needed for Erection

The New York Connecting Railroad was not in operation in 1914, hence all Long Island interchange was floated. Since October 1, 1917, this road, with a car-float service between Greenville and Bay Ridge, has carried Pennsylvania interchange with the Long Island and the New Haven.

Whatever interchange there was between the New York Central and the New Haven was transferred presumably at Port Morris. This tonnage is not included in the New York Central figures.

In Fig. 17 each ton of freight interchanged is recorded twice, credited once to the railroad delivering it and once to the railroad receiving it. Consequently the sum of the areas of the circles will be double the tonnage actually interchanged. Otherwise the chart is made up on the same basis and to the same scales as the preceding charts.

Manhattan Station Tonnages

During the test year, 1914, 6,115,557 tons of freight, or about 8 per cent of the total amount handled by the railroads within the Port District, were handled at the Hudson River pier and inland stations in Manhattan that would be replaced by a West Side joint marginal railroad. The operations employed 484,381 cars, of which 109,263 inbound and 173,270 outbound were empty.

Details of this movement are shown in Table 11 subdivided among the railroads having stations or giving station service in the territory. The New Haven, the Long Island and the Philadelphia & Reading have no such stations.

Although the total inbound tonnage was nearly double the outbound, there was only a comparatively small excess of loaded cars inbound. The reason for this is the higher average loading of inbound cars. At the pier stations and the four inland stations of the New Jersey railroads the average load per loaded car inbound was 10.93 tons, while the average load outbound was 7.06 tons. Taking into account the empty cars, the average load for all cars inbound was 7.89 tons, while the aver-

TABLE 11 — TOTAL TONNAGES BY RAILROADS HANDLED AT HUDSON RIVER PIER AND INLAND RAIL STATIONS SOUTH OF SIXTIETH STREET DURING 1914, AN NUMBER OF CARS EMPLOYED

	Tonnages handled			Number of cars employed								
				Inbound			Outbound			Total		
	Inbound	Outbound	Total	Loaded	Empty	Total	Loaded	Empty	Total	Loaded	Empty	Total
New Jersey railroads												
West Shore	283,733	132,207	415,940	26,164	14,520	40,684	25,748	15,456	41,204	51,912	29,976	81,888
Ontario & Western	28,404	24,163	52,567									
Lackawanna	273,714	203,229	476,943	18,054	20,539	38,593	27,065	11,528	38,593	45,119	32,067	77,186
Erie	446,984	216,682	663,666	44,844	13,643	58,487	37,956	20,531	58,487	82,800	34,174	116,974
Pennsylvania	972,649	505,355	1,478,004	99,434	13,722	113,156	63,226	49,930	113,156	162,660	63,652	226,312
Lehigh Valley	215,627	126,686	342,313	15,361	8,433	23,794	15,746	8,048	23,794	31,107	16,481	47,588
Central of New Jersey	287,282	320,131	607,413	32,635	15,921	48,556	43,854	4,702	48,556	76,489	20,623	97,112
Baltimore & Ohio	267,224	139,042	406,266	19,864	5,493	25,357	15,072	10,285	25,357	34,936	15,778	50,714
Total	2,775,617	1,667,495	4,443,112	256,356	92,271	348,627	228,667	120,480	349,147	485,023	212,751	697,774
New York Central	1,216,587	455,858	1,672,445	118,762	16,992	135,754	82,444	52,790	135,234	201,206	69,782	270,988
Grand total	3,992,204	2,123,353	6,115,557	375,118	109,263	484,381	311,111	173,270	484,381	686,229	282,533	968,762

TABLE 12 — TONNAGES AND CARS HANDLED IN 1914 AT HUDSON RIVER STATIONS SOUTH OF SIXTIETH STREET SEPARATED INTO TWO PIER-STATION GROUPS AND INDIVIDUAL INLAND RAIL STATIONS

	Tonnages handled			Number of cars handled					
				Inbound			Outbound		
Station or group of stations	Inbound	Outbound	Total	Loaded	Empty	Total	Loaded	Empty	Total
Pier stations									
South of 30th street	2,525,885	1,511,385	4,037,270	232,408	96,352	328,760	220,103	108,657	328,760
North of 30th street	193,164	143,260	336,424	16,260	5,673	21,933	16,170	5,763	21,933
Total	2,719,049	1,654,645	4,373,694	248,668	102,025	350,693	236,273	144,420	350,693
Inland stations									
St. Johns Park, N. Y. C.	213,484	107,286	320,770	27,716	2,842	30,558	16,232	14,326	30,558
33d street, N. Y. C.	753,788	205,789	959,577	70,645	....	70,645	38,322	32,323	70,645
25th street, B. & O.	74,465	32,393	106,858	5,385	2,075	7,460	3,275	4,185	7,460
26th street, L. V.	23,760	14,160	37,920	2,167	833	3,000	2,009	991	3,000
28th street, Erie	99,486	44,369	143,855	8,220	95	8,315	5,820	2,495	8,315
37th street, Penna	108,172	64,711	172,883	12,317	1,393	13,710	9,180	4,530	13,710
Total	1,273,155	468,708	1,741,863	126,450	7,238	133,688	74,838	58,850	133,688
Grand total	3,992,204	2,123,353	6,115,557	375,118	109,263	484,381	311,111	173,270	484,381

age load outbound was 4.72 tons. The average loads at the inland terminals were larger than at the pier stations. On the other hand the average loads at the New York Central inland terminals, especially at St. Johns Park, were less than the foregoing figures, and when their tonnages are included the averages per loaded car for all of the terminals under consideration are reduced to 10.64 tons inbound and 6.82 outbound, while the averages for all cars become 8.24 inbound and 4.38 outbound.

It was necessary to assemble these tonnage and car-movement data in such a manner that they could be used in the analyses of any plan to which it might be desired to give consideration. For certain projects the grouping by railroads as in Table 11 is sufficient. In the case of a marginal railroad to serve all of the roads under consideration classification of the traffic by pier stations and inland rail stations rather than by individual railroads is necessary, for the reason that while joint terminals would presumably take all of the traffic of the pier stations and thus relieve the waterfront, the inland stations, with the exception of that at St. Johns Park, would probably remain in service and be connected with the marginal railroad. Table 12 classifies the traffic on that basis.

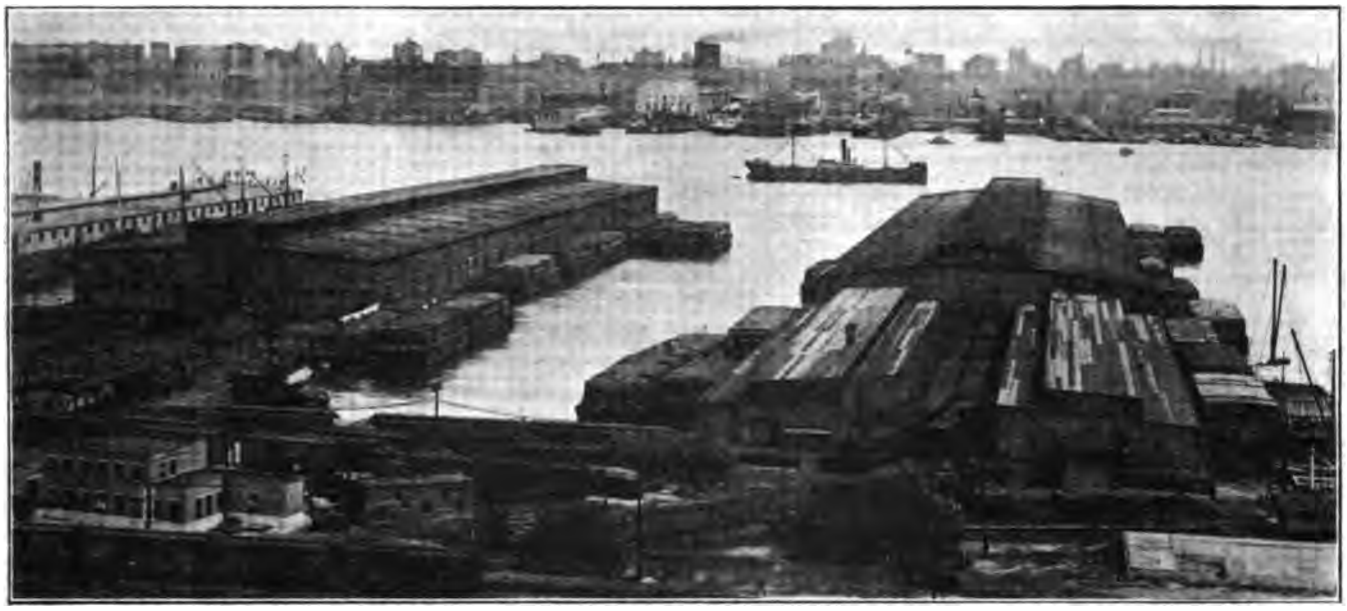
As already stated, the Lehigh Valley and Pennsylvania Railroads control piers alongside the float-bridge entrances to their inland rail stations, and operate them in conjunction with the inland stations. The records did not make any division of the traffic between the piers and the inland yards. To prepare Table 12, therefore, it was necessary to make an arbitrary separation on the basis of judgment, fortified by the indications of the daily clockings. In consequence, the figures all the way across Table 12 opposite these two inland stations, as well as those opposite the two pier-station groups, are approximate. The summations of pier-station and inland rail-station figures both north and south of Thirtieth Street are exact, and any slight inexactness in the details is easily allowed for in the analyses of the various contemplated plans.

Table 13 presents the same data as Table 11 for the East River stations in Manhattan. The stations are all pier stations, and those of the New York, New Haven & Hartford and the Long Island are included. The tonnages in 1914 were about 25 per cent of those at the West Side stations, but their total traffic is growing at a higher percentage rate than that of the West Side stations, for the reason that a number of those on the lower West Side give evidence of having nearly reached their maximum capacity.

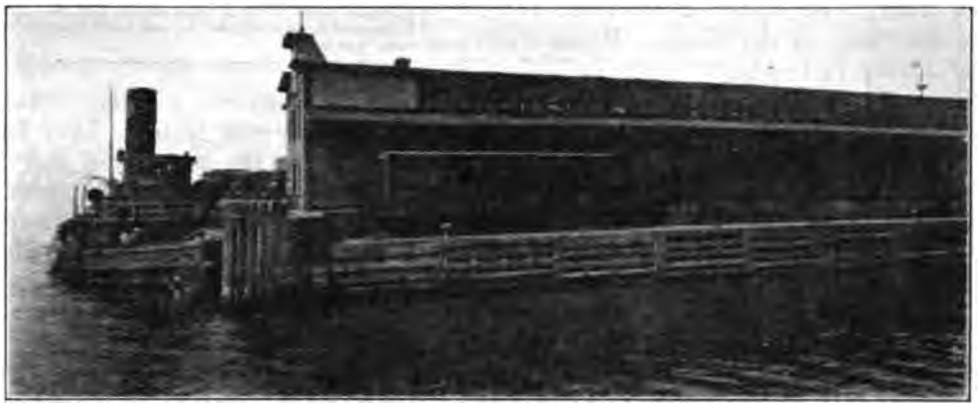
Appended in the table in a single group are also the five pier and inland rail stations on the Harlem River or near its mouth, in both Manhattan and the Bronx.

TABLE 13 — TOTAL TONNAGES HANDLED AT EAST RIVER PIER STATIONS (MANHATTAN) SOUTH OF SIXTIETH STREET DURING 1914, AND NUMBER OF CARS EMPLOYED

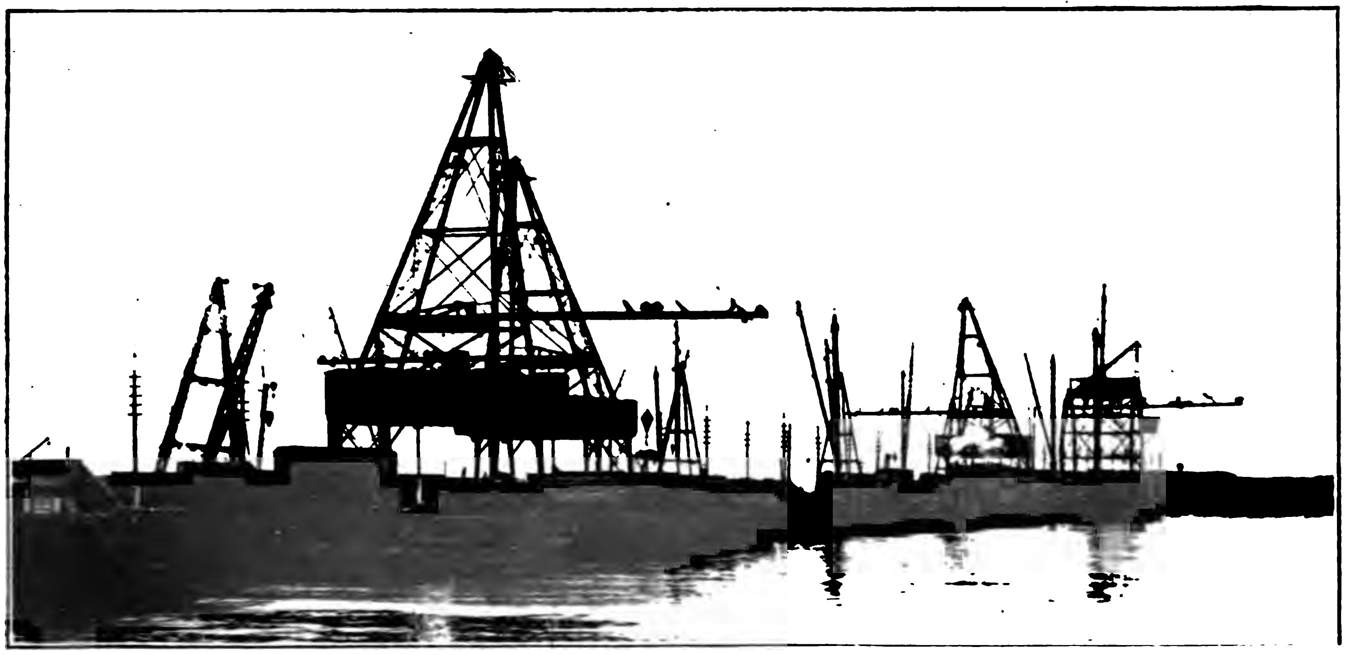
	Tonnages handled			Number of cars employed								
				Inbound			Outbound			Total		
Railroad	Inbound	Outbound	Total	Loaded	Empty	Total	Loaded	Empty	Total	Loaded	Empty	Total
New Jersey railroads												
West Shore	42,654	17,181	59,835	3,574	2,686	6,260	2,501	535	3,036	6,075	3,221	9,296
Ontario & Western	1,553	6,502	8,055	122	48	170	947	272	1,219	1,069	320	1,389
Lackawanna	40,439	25,865	66,304	3,317	1,871	5,188	1,602	3,586	5,188	4,919	5,457	10,376
Erie	31,888	64,107	95,995	1,704	4,428	6,132	5,448	684	6,132	7,152	5,112	12,264
Pennsylvania	....	50,433	50,433	....	5,191	5,191	4,511	680	5,191	4,511	5,871	10,382
Lehigh Valley	76,552	7,720	84,272	3,916	494	4,410	826	3,584	4,410	4,742	4,078	8,820
Central of New Jersey	....	....	....	....	....	....	....	....	....	....	....	....
Baltimore & Ohio	12,923	32,610	45,533	926	2,231	3,157	2,964	193	3,157	3,890	2,424	6,314
Total	206,009	204,418	410,427	13,559	16,949	30,508	18,799	9,534	28,333	32,358	26,483	58,841
New York railroads												
New York Central	135,396	73,291	208,687	10,795	4,955	15,750	10,670	7,255	17,925	21,465	12,210	33,675
New Haven	331,025	409,267	740,292	38,966	16,212	55,178	46,571	8,607	55,178	85,537	24,819	110,356
Long Island	35,614	111,150	146,764	8,086	4,692	12,778	12,312	466	12,778	20,398	5,158	25,556
Total	502,035	593,708	1,095,743	57,847	25,859	83,706	69,553	16,328	85,881	127,400	42,187	169,587
Total south of 60th street	708,044	798,126	1,506,170	71,406	42,808	114,214	88,352	25,862	114,214	159,758	68,670	228,428
Harlem river stations	227,909	99,768	327,677	17,484	1,390	18,874	11,125	7,749	18,874	28,609	9,139	37,748
Grand total	935,953	897,894	1,833,847	88,890	44,198	133,088	99,477	33,611	133,088	188,367	77,809	266,176



Combination of Single-Shedded and Double-Shedded Lighterage Piers at Waterfront Yard



Covered Lighterage Pier With Track Along One Side of the Shed



Open Lighterage Pier at Waterfront Yard Equipped With Straight-Line Gantry Cranes for Handling Bulk Freight

TABLE 14.— TOTAL TONNAGE BY RAILROAD GROUPS THAT SYSTEM RECOMMENDED BY THE COMMISSION FOR MANHATTAN MIGHT HAVE HANDLED DURING 1914

Railroad	Inbound	Outbound	Total
New Jersey railroads			
Hudson river pier stations	2,469,731	1,511,832	3,931,596
Inland rail stations, 89 per cent	291,841	117,505	409,349
East river pier stations	206,009	201,418	410,427
Total	2,967,587	1,833,785	4,801,372
New York Central			
Hudson river pier stations	249,315	142,783	392,098
St. Johns Park, 100 per cent	213,484	107,286	320,770
Thirty-third street, 67 per cent	532,662	105,792	638,454
East river stations	135,396	73,291	208,687
	1,130,857	429,152	1,560,009
Total New Jersey railroads and New York Central	4,098,444	2,262,937	6,361,381
New York, New Haven & Hartford	331,025	409,267	740,292
Long Island	35,614	111,150	146,764
Harlem river stations	227,909	99,768	327,677
Grand total	4,692,992	2,833,122	7,576,114

Table 14 is a basic table derived from Tables 11, 12 and 13 to show the tonnages that the system recommended by the Commission would have handled during 1914, both on the basis of the single loop designed to accommodate only the New Jersey railroads and the New York Central and on that of the expanded system outlined in the general plan to include the tonnages of the New York, New Haven & Hartford and the Long Island, and those of the Harlem River stations of the New Jersey railroads.

This table takes no account of cars required, for the reason that the automatic-electric system calls for the turning back of virtually all standard cars at the joint yard or the corresponding yard used by the New York Central. The number of cars to be handled in the steam sections of these yards under the changed method of operation can be approximated from Tables 11 and 13.

The study of the requirements for the recommended system is completed by means of Table 15, which shows the total tonnages the system as originally analyzed would have had to accommodate in each year from 1905 to 1919 inclusive. From this table a normal trend curve has been developed (Fig. 18) in which allowance is made for the deviation of each year's total from the normal trend. This curve projected into the future shows tonnages of approximately 9,000,000 and 10,000,000 respectively for 1924 and 1929 for the New Jersey railroads and the New York Central.

A second trend curve drawn to include the New Haven and Long Island tonnages in Manhattan, also shown in Fig. 18, indicates total tonnage of 10,500,000 and 11,500,000 for 1924 and 1929 respectively.

A number of charts have been prepared to show graphically features of the tonnage records not brought out by the tables. They have been of considerable use in the analyses of the various West Side and Manhattan freight plans considered.

Figs. 19–28 present much information as to the traffic of the individual stations, under the three main

TABLE 15 — TOTAL TONNAGES BY YEARS HANDLED BY NEW JERSEY RAILROADS AND NEW YORK CENTRAL AT MANHATTAN STATIONS*

Year	Tonnage	Year	Tonnage	Year	Tonnage
1905	5,644,536	1910	6,251,499	1915	6,759,455
1906	6,070,016	1911	6,222,480	1916	7,857,315
1907	6,152,581	1912	6,602,806	1917	8,010,195
1908	5,432,027	1913	6,707,322	1918	7,718,890
1909	6,033,963	1914	6,361,381	1919	†7,863,854

* Excludes piers north of 60th street, and also team-track freight.

† Estimated figures included for last three months; actual figures not available when study was made.

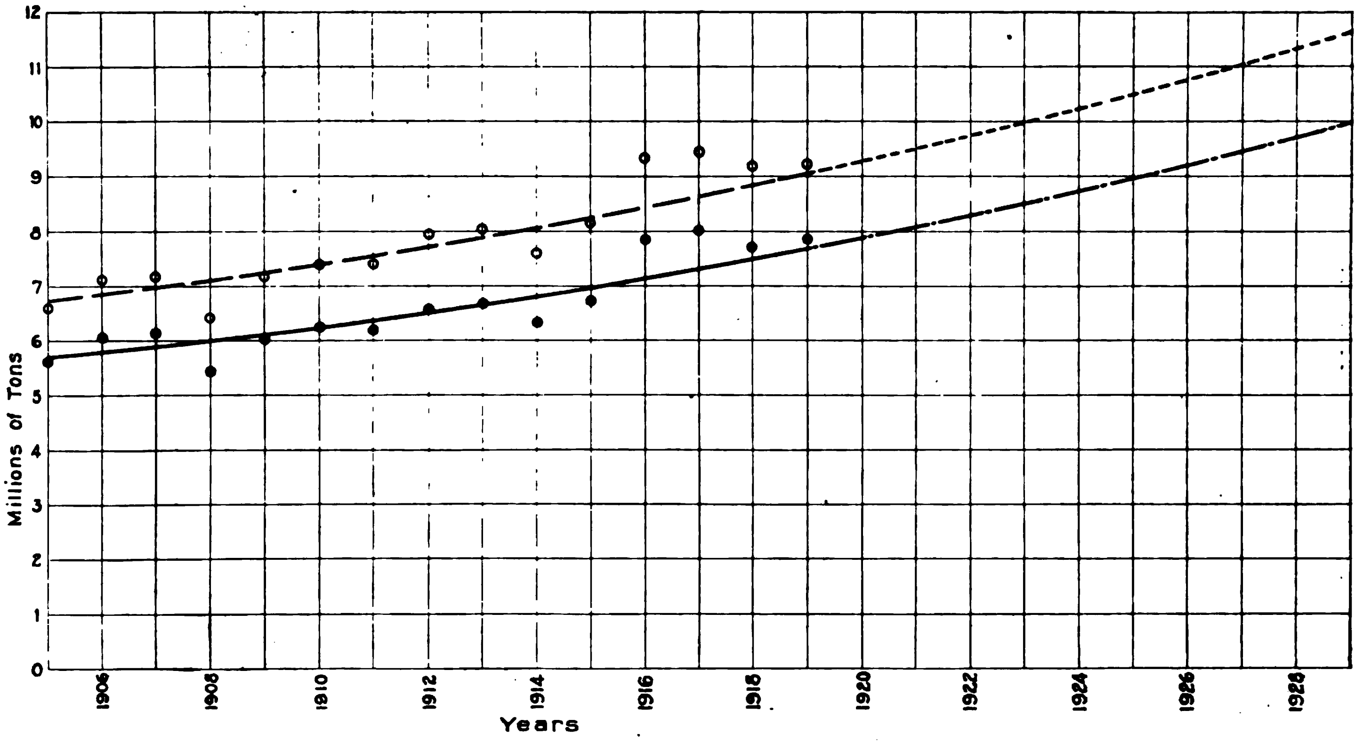


FIG. 18 — Trend of Manhattan Station Traffic

Lower line tonnage West Side stations; upper line that of West Side, East Side and Harlem River stations headings of tonnage, cars and tonnage per car. They give a good index of the efficiency of the various stations from the standpoint of both volume of traffic and balance of traffic in the two directions.

Fig. 19 indicates the tonnage at each station in each direction. It shows the wide variations between the different stations, with the heaviest loads coming in the Barclay-Desbrosses Street section and with light loads above Fourteenth Street.

Fig. 20 is comparable with Fig. 19. It shows at each station the movement in each direction of loaded cars, and also that of empty cars. The sections of the bars indicating loaded movement in Fig. 20 conform roughly with the bars in Fig. 19, deviating from them to the extent that the average load per car at the particular station varies from that at all stations.

The information in Figs. 19 and 20 is put on a percentage basis in Figs. 21 and 22 respectively. The

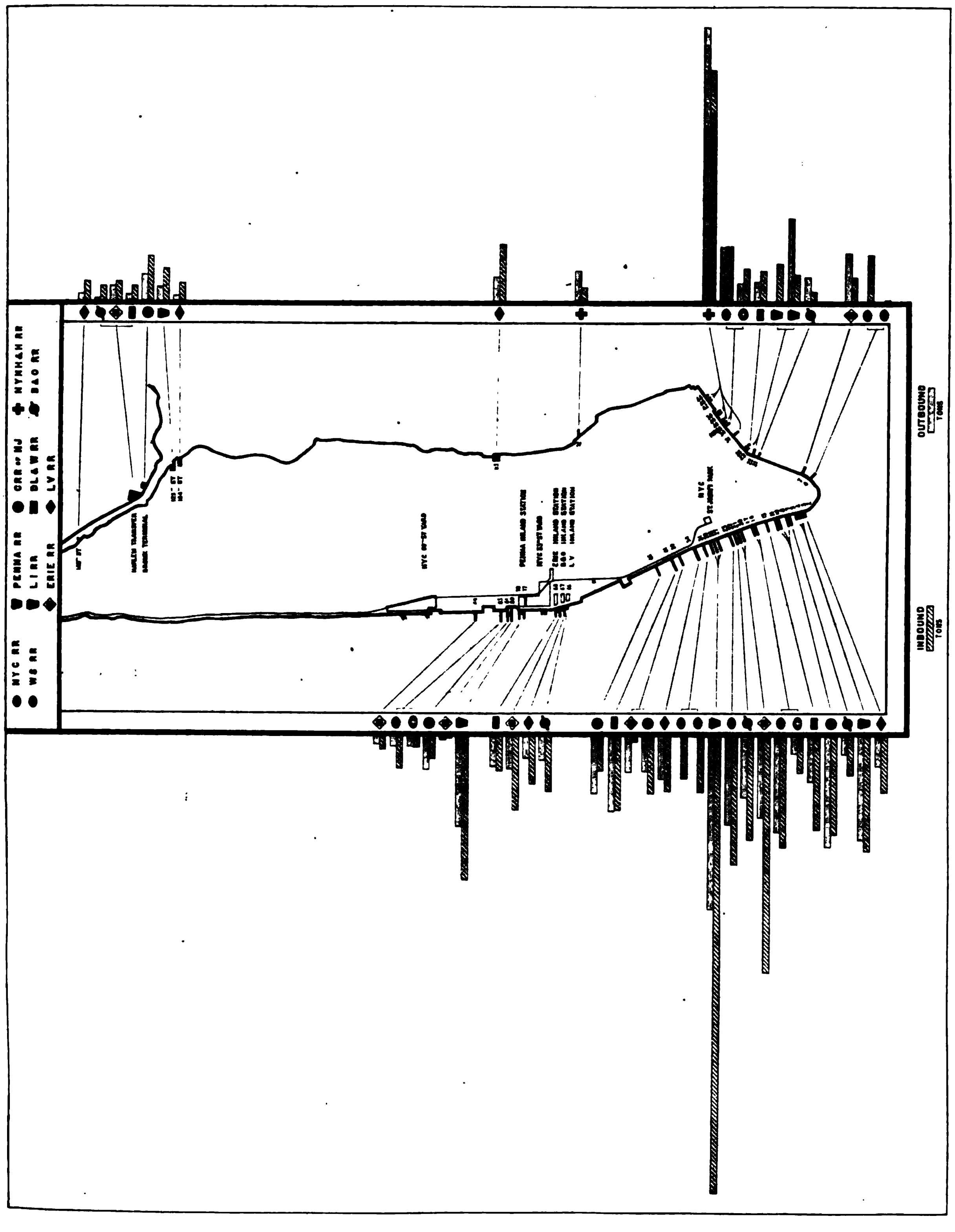


FIG. 19 — Volume of Traffic Handled in 1914 at Individual Manhattan Pier Stations, in Short Tons — Inbound and Outbound

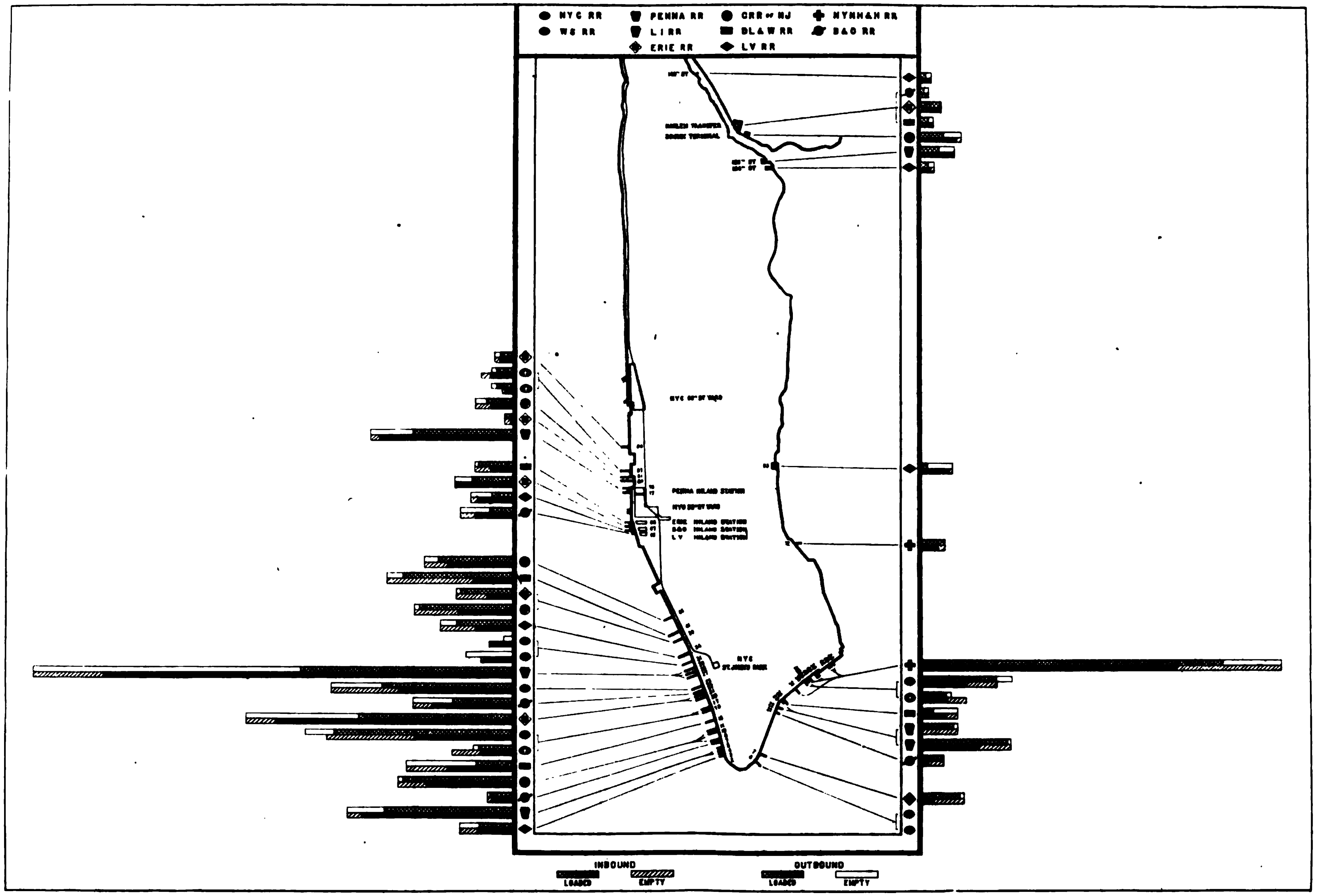


FIG. 20 – Total Number of Cars, Loaded and Empty, Handled in 1914 at Individual Manhattan Pier Stations — Inbound and Outbound

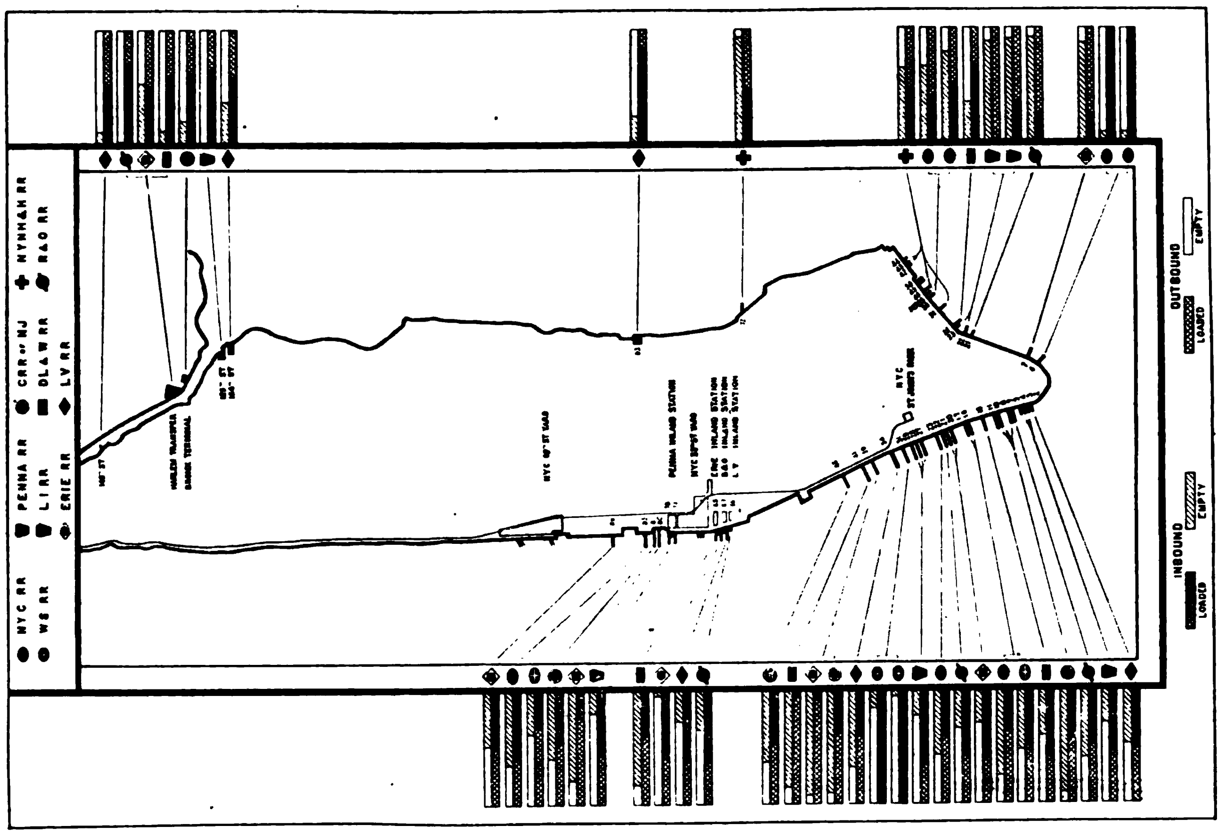


FIG. 22 — Percentages of Loaded and Empty Cars Inbound and Outbound

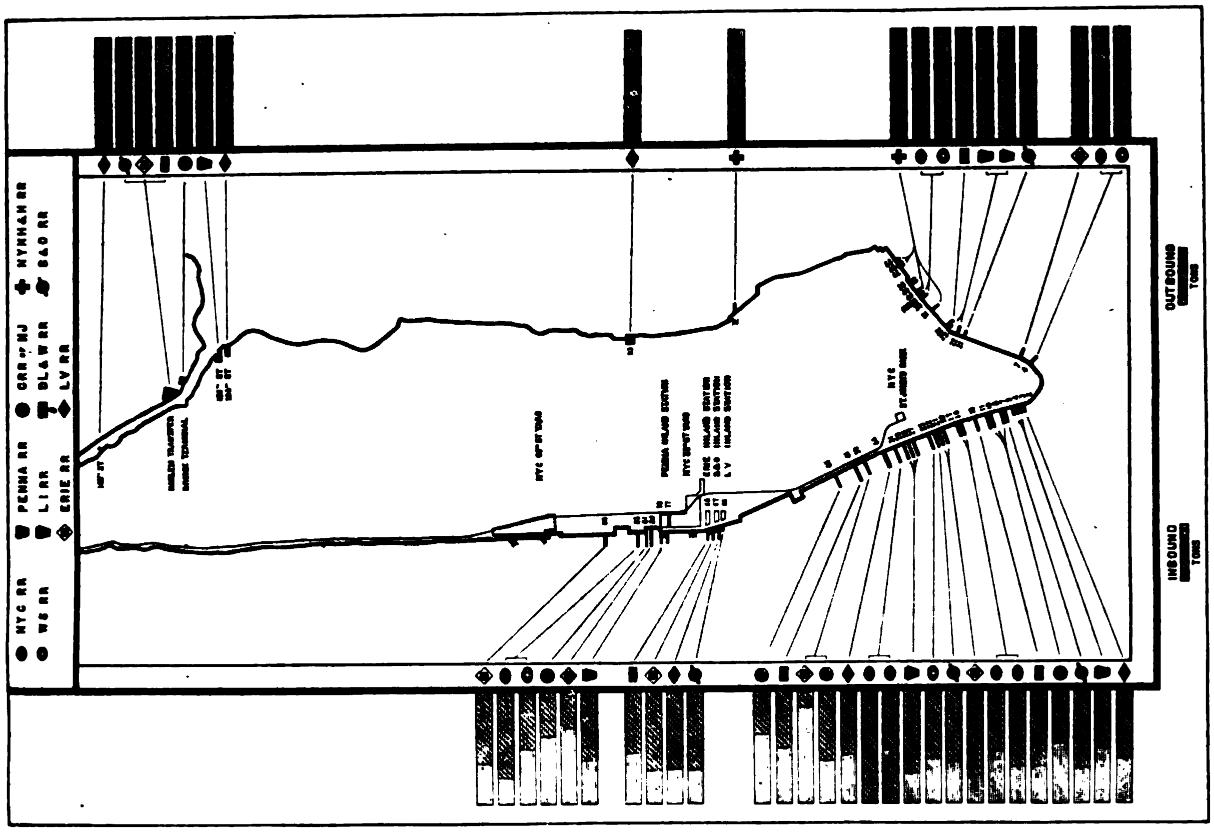


FIG. 21 — Percentages of Traffic Inbound and Outbound in Short Tons

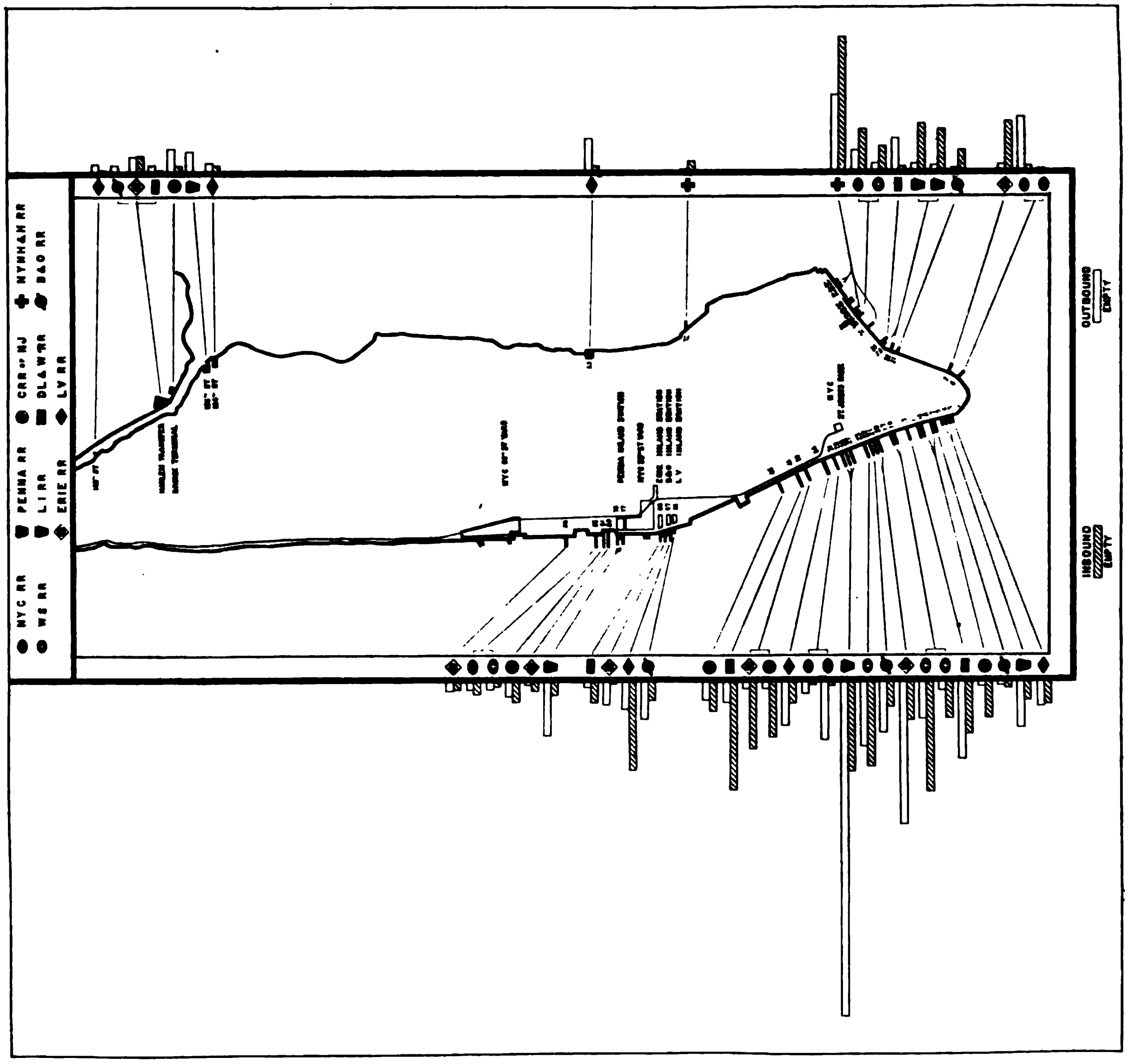


Fig. 23 — Number of Empty Cars Only Handled at Individual Stations — Inbound and Outbound

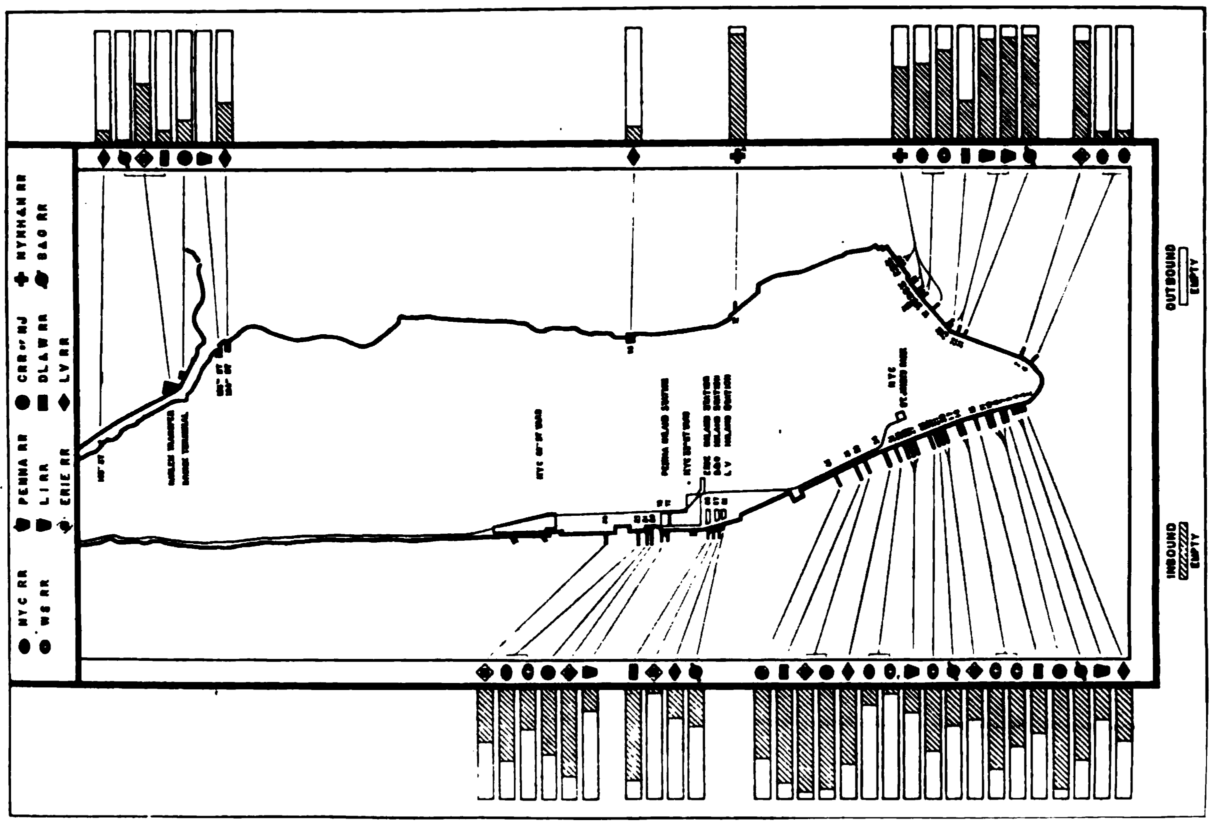


Fig. 24 — Percentages of Empty Cars Moved Inbound and Outbound

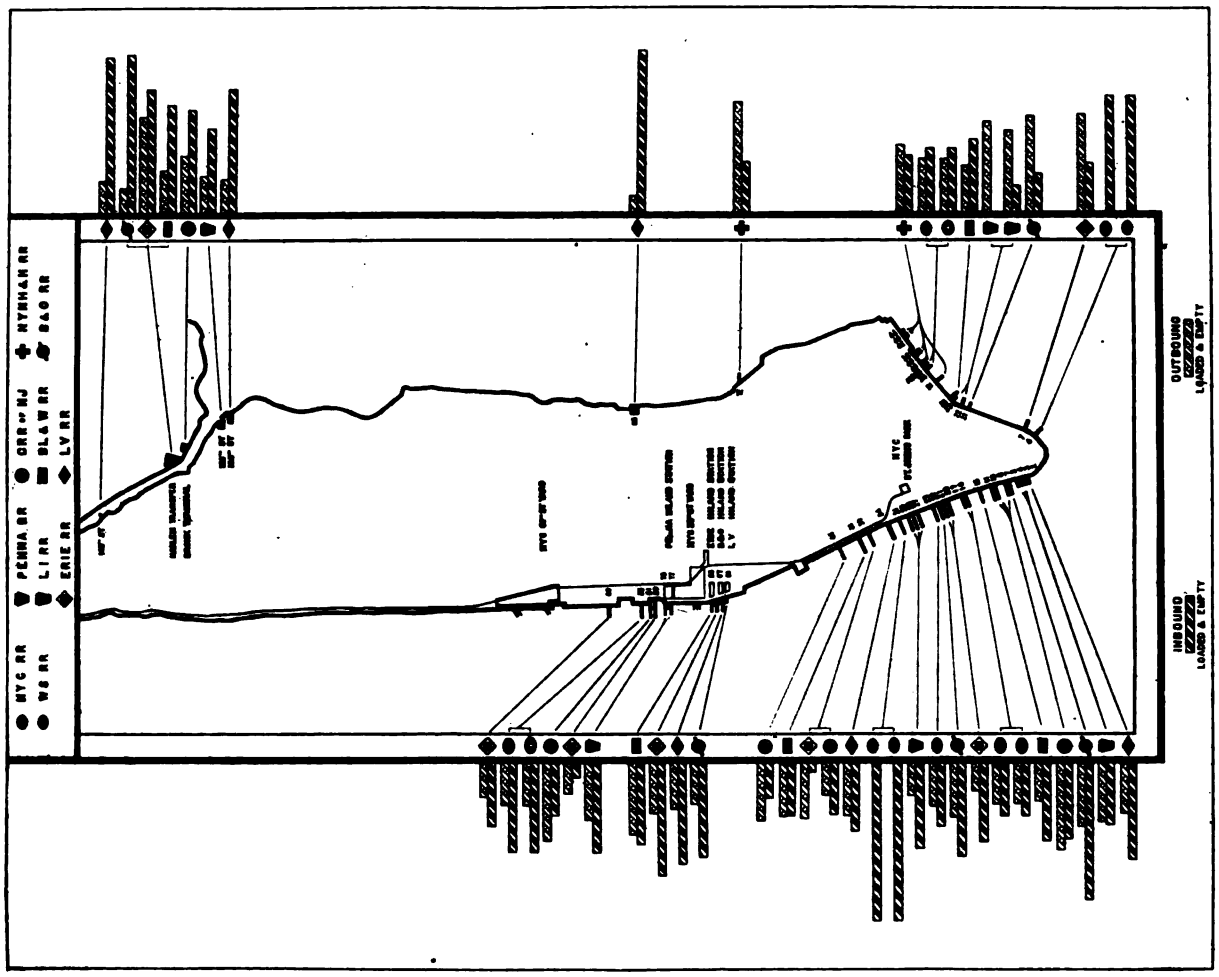


FIG. 26 — Average Loads per Car, Inbound and Outbound, on Basis of All Cars

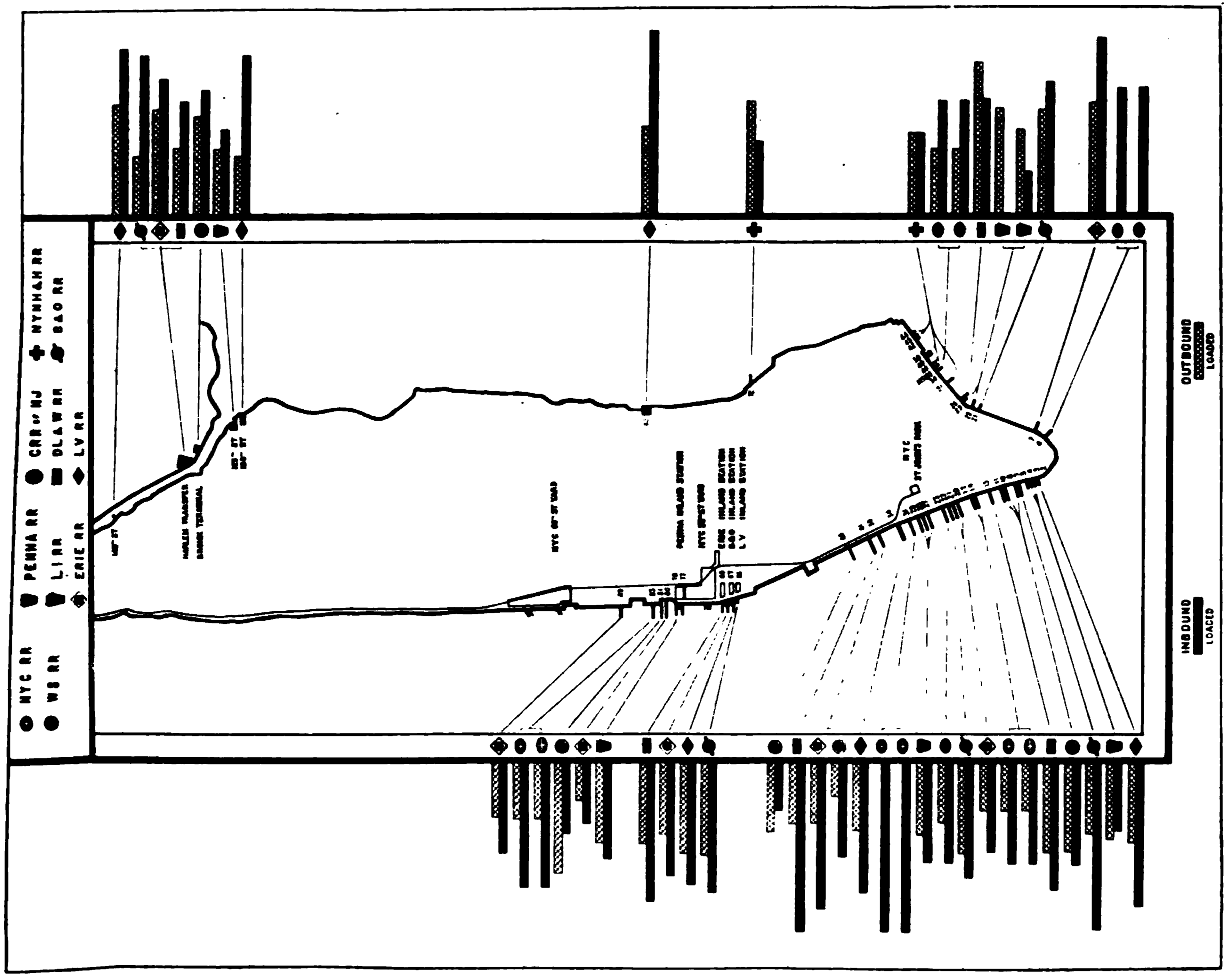


FIG. 25 — Average Loads per Car, Inbound and Outbound, on Basis of Loaded Cars Only

four charts show that while at some stations the unbalanced traffic causes a considerable empty car movement in one direction, at other stations where the traffic is well-balanced there is a large movement of empty cars in each direction.

Figs. 23 and 24 show the empty movement in cars

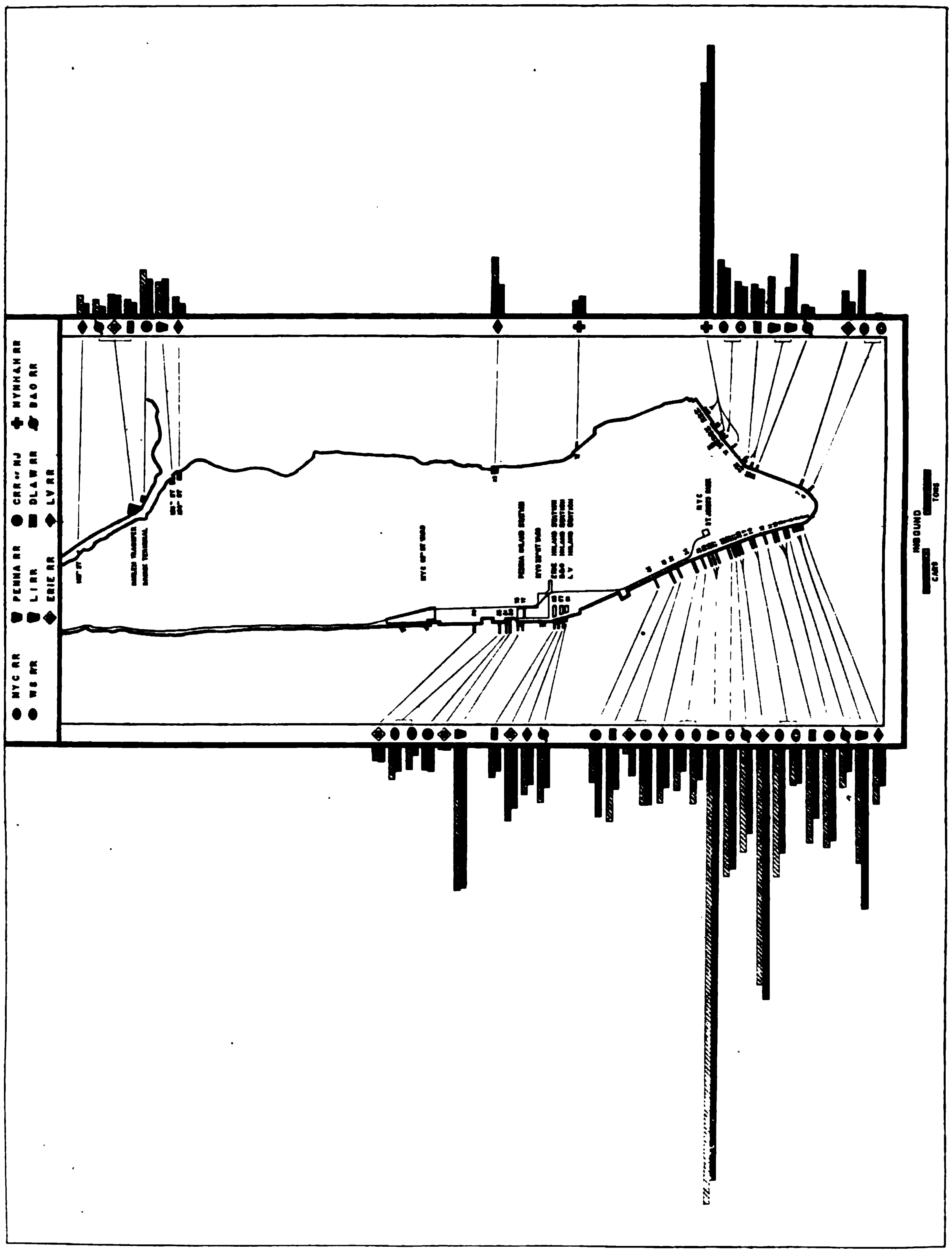


FIG. 27 — Comparison of Inbound Tonnages in 1914 at Individual Manhattan Pier with Number of Loaded Cars Handled

and percentages. The bars on the former are a reproduction of the outer portions of the bars of Fig. 20.

Fig. 25 shows the average load per loaded car at each station in each direction. Corresponding with the average previously mentioned of 10.93 tons per inbound car are individual averages ranging from 5 to 18 tons, while corresponding with the outbound general average of 7.06 tons are individual figures as low as 2.5 tons and as high as 17 tons.

Fig. 26 shows the average load per car on the basis of all cars, loaded and empty.

Figs. 27 and 28 compare the tonnages at each station with the number of loaded cars, inbound and outbound respectively.

There were wide monthly fluctuations in the traffic of some of the railroads. This is particularly true of the New York Central, Pennsylvania and Erie, which receive large quantities of fruit and produce in season. Figs. 29 and 30 show these facts graphically. They are of value as a guide in determining how greatly the normal traffic is sometimes exceeded for short periods. It will be noted that the peaks do not coincide.

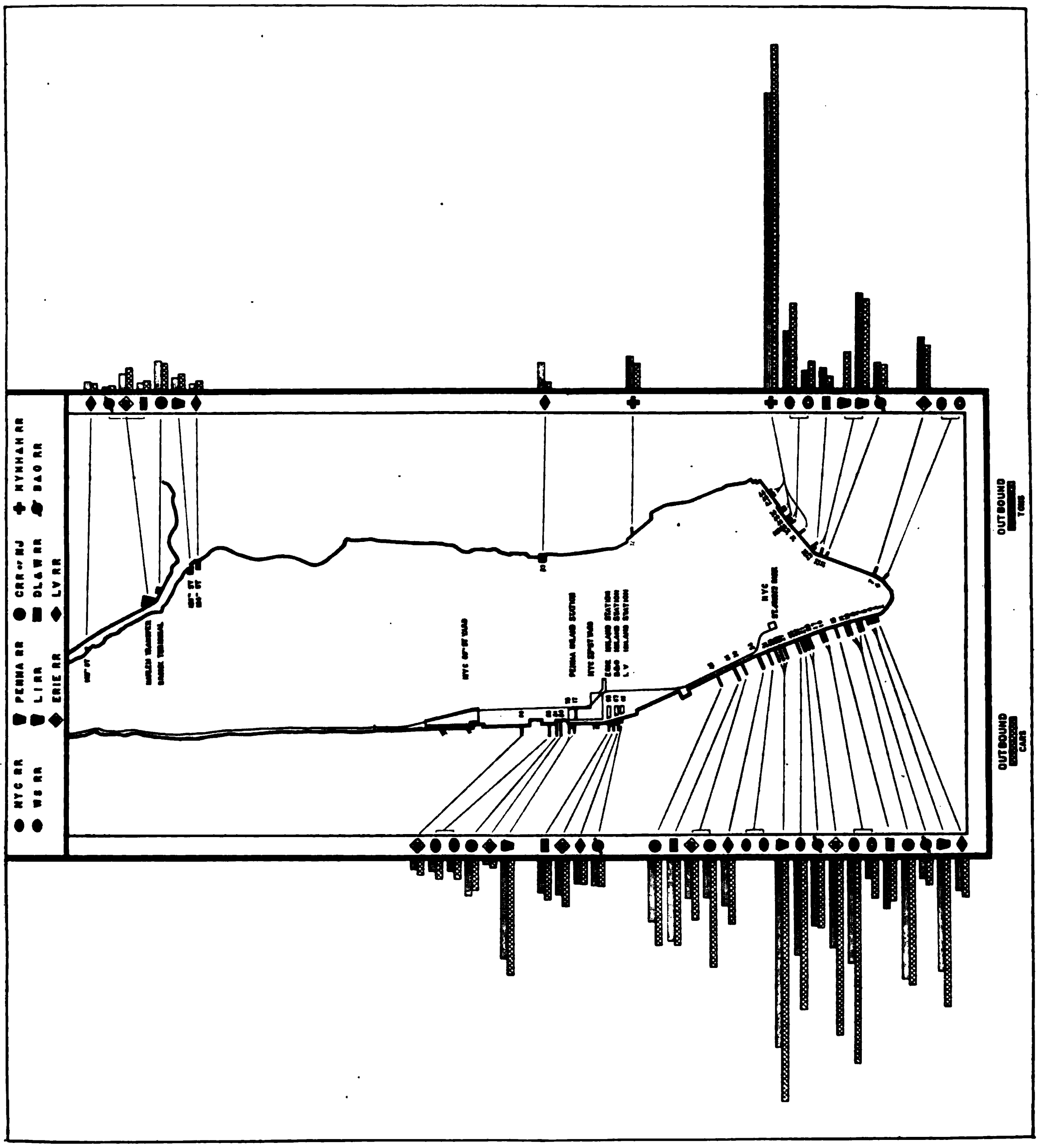


Fig. 28 — Comparison of Outbound Tonnages in 1914 at Individual Stations with Number of Loaded Cars Handled

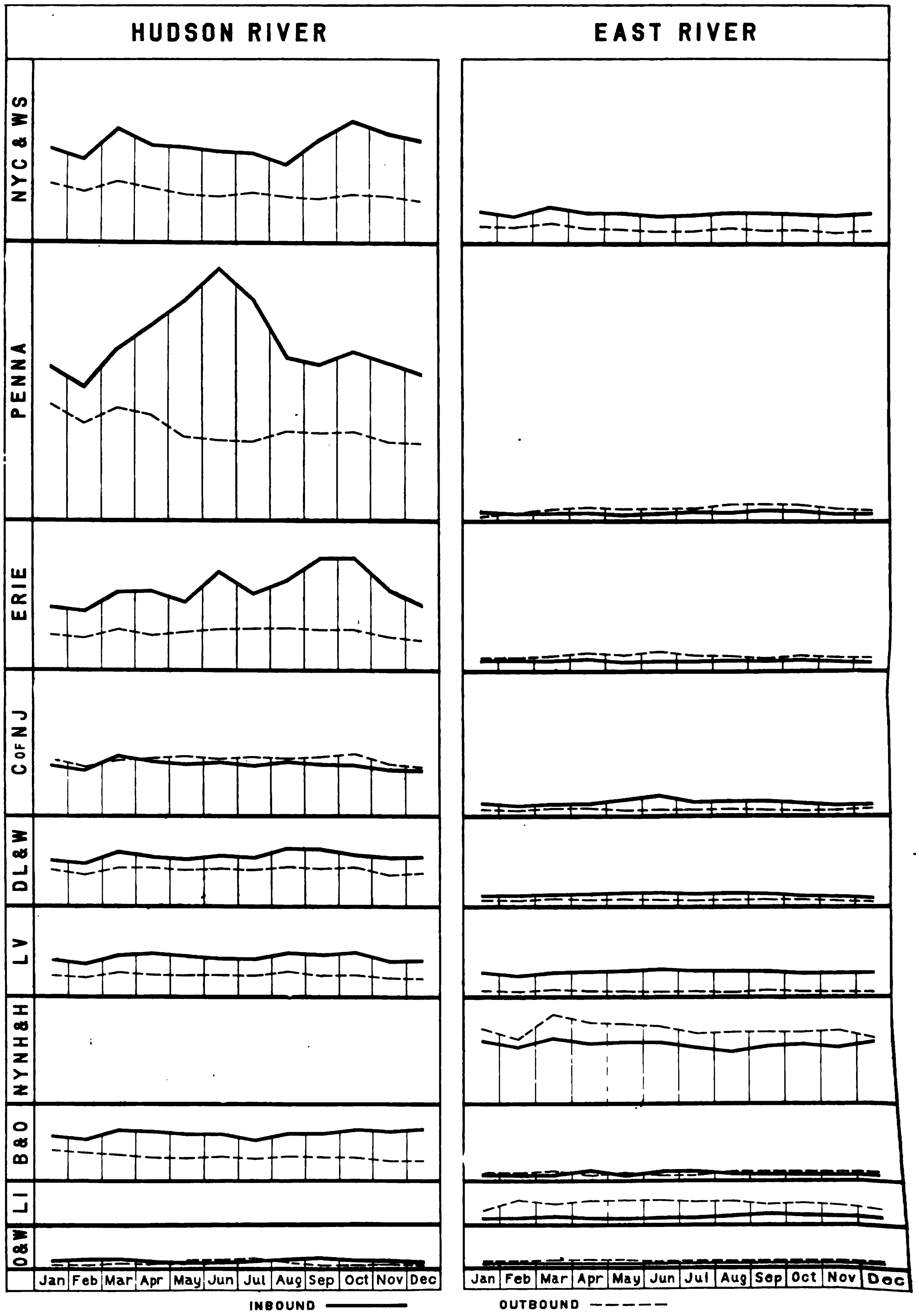


Fig. 29 — Monthly Fluctuations of 1914 Manhattan Pier-Station Tonnages — By Railroads, Hudson River and East River Separately.

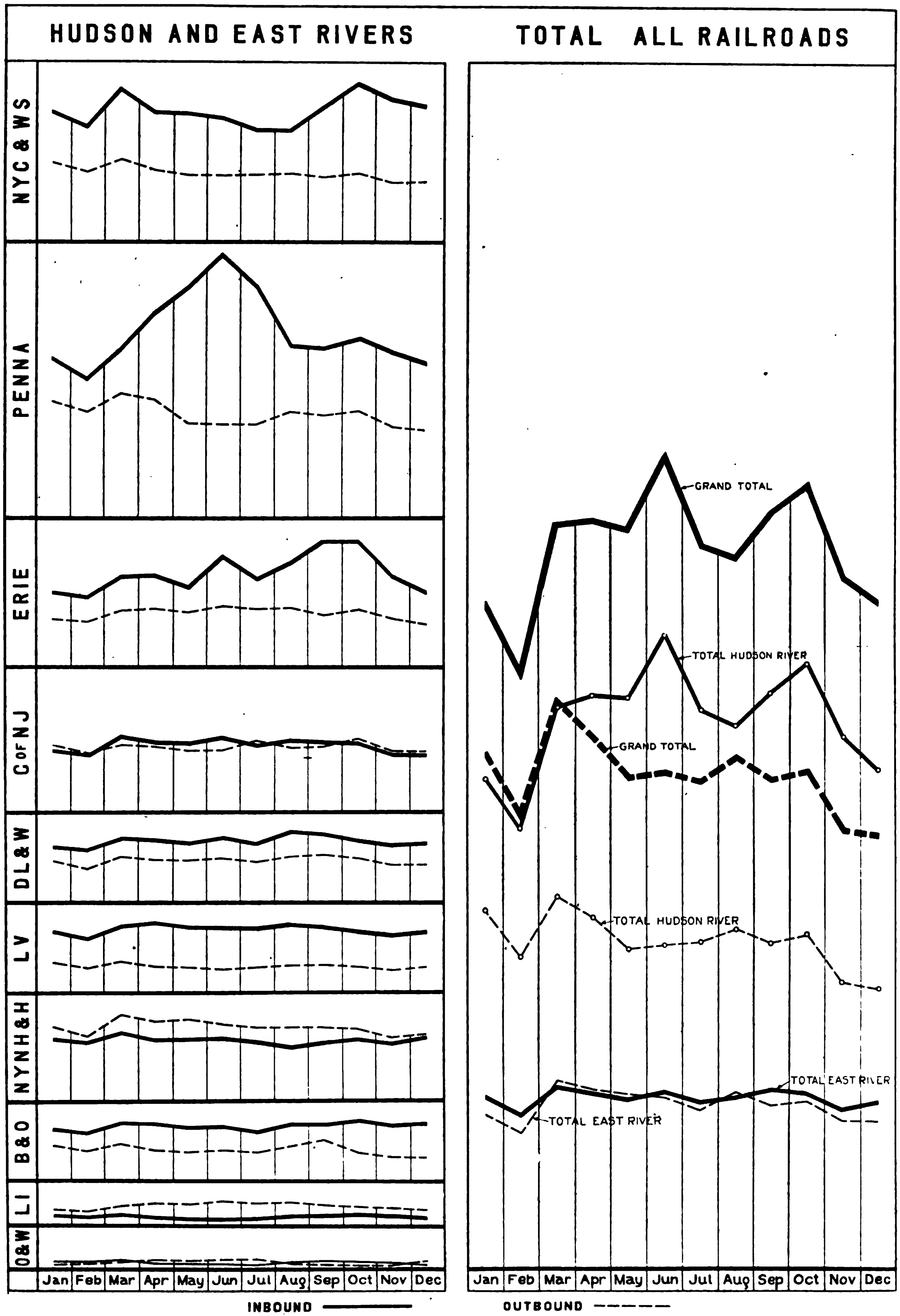


FIG. 30 — Monthly Fluctuations of 1914 Manhattan Pier-Station Tonnages — By Railroads. Both Rivers. and Total, All Railroads

V — COSTS

According to the records of the representative railroads interpreted in the manner already set forth, the average cost of terminal operations for the carriers during 1914 was about $1.60 per ton for goods handled at Manhattan pier stations or inland rail stations; $1.48 per ton for goods handled at Brooklyn, Harlem and Bronx stations and $2.14 per ton for goods lightered. These figures cover the entire cost to the carrier from the time the inbound train comes to a stop in the break-up yard to the delivery of the freight by the carrier by whatever means, or from the receipt by the carrier of outbound freight to the made-up train ready to depart from the break-up yard. The figures vary widely according to the conditions at the existing terminals, the average loading of cars, the length of water haul and numerous other variables.

Prices of material and labor advanced greatly between 1914 and 1918. On the basis of 1918 prices it is estimated that the terminal costs were about $2.25 per ton at Manhattan stations, $2.08 at Brooklyn, Harlem and Bronx stations and $3.01 for freight lightered.

TABLE 16 — ELEMENTS BY SUCCESSIVE OPERATIONS ENTERING INTO AVERAGE COST TO RAILROADS PER CAR IN 1914 TO OPERATE THEIR HUDSON RIVER PIER AND INLAND RAIL STATIONS — FROM BREAK-UP YARD TO STATION FLOOR

Successive operations	Direct costs	Fixed charges	Total
Classification at break-up yard	$.5622	$.1979	$.7601
Breaking bulk at transfer platform	2.7191	.0449	2.7640
Line haul between yards and terminals	.4141	.2833	.6974
Switching and bridging at waterfront	1.0153	.8790	1.8943
Car-float operations	1.3212	.2846	1.6058
Handling freight at terminal stations	3.8017	2.0986	5.9003
Total by operations	$9.8336	$3.7883	$13.6219
Average total per car delivered	$6.5821	$3.5055	$10.0876

Still another set of figures has been derived to bring the costs up to the 1920 price level. This level is regarded as abnormal, however, and the Commission prefers to base its recommendations on 1918 prices.

MANHATTAN STATIONS

From the standpoint of this report the most important railroad tonnage costs are those applying to the Manhattan pier and inland rail stations, inasmuch as they were the basis for the analysis in detail of the several plans considered for serving Manhattan. Tables 16 and 17 show by successive operations the elements entering into the terminal costs. Table 16 is on the basis of cars, Table 17 on the basis of tons. The costs in each case are subdivided into the two main heads of (1) direct costs, which include general administration, operation, maintenance of way and structures and maintenance of equipment, and (2) fixed charges, which include taxes, rentals and interest on investment.

TABLR 17 — ELEMENTS BY SUCCESSIVE OPERATIONS ENTERING INTO AVERAGE COST TO RAILROAD PER TON IN 1914 TO OPERATE THEIR HUDSON RIVER PIER AND INLAND RAIL STATIONS — FROM BREAK-UP YARD TO STATION FLOOR

Successive operations	Direct costs	Fixed charges	Total
Classification at break-up yard	$.0858	$.0302	$.1160
Breaking bulk at transfer platform	.4273	.0071	.4344
Line haul between yards and terminals	.0645	.0441	.1086
Switching and bridging at waterfront	.1599	.1384	.2983
Car-float operations	.2094	.0451	.2545
Handling freight at terminal stations	.6022	.3324	.9346
Total by operations	$1.5491	$.5973	$2.1464
Average total per ton delivered	$1.0427	$.5553	$1.5980

Table 16 shows a total cost per car of $10.0876. Table 17 shows a total of $1.5980 per ton. It will be noted that each total exceeds the corresponding total per car delivered and per net ton delivered. The reason for this is that not every ton or every car goes through all stages of the operation. For example, only a small percentage of the freight goes over the local transfer platforms, and the deduction of that item alone would bring the totals down nearly to those per car and per net ton delivered.

The cost per car takes into account the large movement of empty cars. The cost per loaded car delivered was computed to be $14.2408.

Tables 18 and 19, following the same form as Tables 16 and 17, bring the costs to a 1918 basis as determined by the study of price increases. The principal increases are in labor and materials, the average increase being found to be 59 per cent. The increase of 13 per cent in fixed charges is due mainly to increased taxes.

TABLE 18 — COST ELEMENTS PER CAR AS IN TABLE 16, BROUGHT TO 1918 SCALE OF PRICES

Successive operations	Direct cost	Fixed charges	Total
Classification at break-up yard	$.8942	$.2197	$1.1139
Breaking bulk at transfer station	4.2416	.0498	4.2914
Line haul between yards and terminals	.6582	.3145	.9727
Switching and bridging at waterfront	1.6054	.9758	2.5812
Car-float operations	2.0691	.3159	2.3850
Handling freight at terminal stations	5.9441	2.3295	8.2736
Total by operations	$15.4126	$4.2052	$19.6178
Average total per car delivered	$10.3281	$3.8912	$14.2193

The average costs found by these tables are $14.2193 per car delivered, $20.0736 per loaded car delivered and $2.2525 per net ton delivered.

All of these figures are on the basis of a 5 per cent interest rate for money. At the present time money is not obtainable at this rate. In the analyses of the plans for Manhattan, figures are derived for money rates at 6 per cent and 7 per cent. At 6 per cent and 7 per cent the 1918 costs per ton would be $2.2890 and $2.3255 respectively.

At 1920 prices the costs per ton are estimated at $2.8237, $2.8602 and $2.8967 corresponding to interest rates of 5, 6 and 7 per cent.

BROOKLYN AND HARLEM STATIONS

The marine operations to and from Brooklyn and

TABLE 19 — COST ELEMENTS PER TON AS IN TABLE 17, BROUGHT TO 1918 SCALE OF PRICES

Successive operations	Direct cost	Fixed charges	Total
Classification at break-up yard	$.1364	$.0335	$.1699
Breaking bulk at transfer station	.6667	.0078	.6745
Line haul between yards and terminals	.1024	.0490	.1514
Switching and bridging at waterfront	.2528	.1537	.4065
Car-float operations	.3280	.0500	.3780
Handling freight at terminal stations	.9416	.3690	1.3106
Total by operations	$2.4279	$.6630	$3.0909
Average total per ton delivered	$1.6361	$.6164	$2.2525

Harlem stations tend to be more costly per ton of freight moved because of the greater distance of water travel. On the other hand a large percentage of the stations are float-bridge terminals, at which the consignee receives coarse freight on team tracks and unloads it himself, saving the carrier that expense. The records do not permit a precise comparison between these stations and the Manhattan stations.

LIGHTERAGE

Precise figures for the cost of lighterage service were not obtainable because of the absence of records of the cost of unloading goods from lighters at the point of delivery and loading them upon lighters at the point of receipt. The first three successive operations shown in Tables 16–19 for car-float service are the same for lighterage service. The marine operations were found to average about 40 cents per ton higher than the marine operations in the car-float service. The handling charges at the lighterage piers were determined, and were found to average considerably less than the handling charges at pier stations. The unknown element is the handling charge at the other end of the lighterage journey, but it can probably be assumed to be about the same as that at the lighterage pier. On this basis the total handling charge will probably average about 37.3 cents more than the handling charge in the car-float operation, and the total lighterage operation at 1914 prices will be brought to $2.3710 per ton.

Because of the difficulty of ascertaining this figure for handling at the ship or the point of local origin or destination, no attempt has been made to arrive at a precise figure for the 1918 cost of lighterage. As prices have gone up roughly proportionally the total operation in 1918 must have been costing at least $3 per ton.

PRIVATE TERMINALS

Private terminals received from the carriers in 1914 from 3 to 4.2 cents per 100 lb. for their service, which replaced the marine operations and the terminal handling operations of the carriers, but did not relieve them of the first four operations covered in Tables 16–19. At these rates the allowance to the private terminal averaged about 70 cents per ton, corresponding to $1.1891 average costs to the carrier to operate their own Manhattan facilities. This would seem to substantiate the assertions of the private companies that at the 1914 rates their terminal operations were not profitable.

The rates have been materially increased since 1914, the limits now being 84 cents and $1.48 per ton. These figures would bring the average allowance made by the railroads up to 99 cents per ton as compared with a cost to operate their own Manhattan facilities of $1.6886 per ton. The new rates do not seem to have more than taken up the increased cost.

VI — MISCELLANEOUS STUDIES

Of the miscellaneous railroad studies not classifiable as either tonnage or cost studies have been mentioned the studies of the empty movement and wasted effort in the Manhattan-station service, and the car-detention studies.

EXCESS EMPTY MOVEMENT AND WASTED EFFORT

Study of the charts, Figs. 21–30, will reveal much as to the causes of the large empty-car movement. For example, it will show that whereas the preponderance of the total traffic is inbound, the greater part of the traffic from Pier 41 is outbound, and consequently there must be a large movement of empty cars inbound to receive this freight. The reason is not so apparent why at Pier 23, where the tonnage is almost balanced, there is a movement in each direction of approximately one empty car to two loaded cars.

There are three principal underlying causes of this empty movement, apart from the preponderance of inbound freight — a condition which cannot be controlled. The three causes are the lighter loading of westbound cars, which makes it necessary to bring empty cars to the stations even when the tonnage in the two directions is balanced; the preponderance of westbound traffic at certain individual stations, and the per diem rules of the American Railway Association. These per diem rules impose a charge against each road for holding the cars of the other roads, and the charge is sufficiently high to impel the road in most instances to return its foreign cars as promptly as possible. This means that foreign cars arriving with loads at a terminal are not held for reloading unless freight is available for points on the line of the owner, the railroads finding it cheaper to turn the cars back empty and bring in other empty cars for the outbound freight. This is the most prolific cause of the empty movement, and is one which if removed by a pooling of equipment authorized by the Federal authorities would greatly reduce terminal costs at the Port of New York and elsewhere.

The cost of this wasted effort due to the moving of excess empty cars into and out of the terminals under consideration amounted in 1914 to 6.95 per cent of the total cost of the terminal operation, or 17.26 per cent of the car-handling costs, according to the special study previously mentioned. This means 70 cents per car delivered or 11 cents per ton delivered. Of this 6.95 per cent, 1.97 per cent is ascribable to lighter loading westbound, 0.64 per cent to preponderance of outbound traffic at individual stations and 4.34 per cent to the per diem rules and other causes. The necessary empty movement to take care of the preponderance of inbound traffic was not considered.

CAR DETENTION

The special study of the average time required by a car serving a West Side terminal to make the turnaround from break-up yard to break-up yard showed this to be approximately three and one-half days. To handle the 9,000,000 tons of freight indicated by the trend curve (Fig. 18) for the tonnage expected in 1924 at the Manhattan stations served by the New Jersey railroads and the New York Central would require 2,500,000 car-days, it is estimated. The system recommended would require 850,000 car-days. The saving would be about 1,650,000 car-days, which at the prevailing per diem rates of 75 cents would amount to $1,237,500 per year.

CHAPTER 7

Present Steamship Facilities, Methods, Tonnages and Costs

I — GENERAL

Probably 45,000,000 tons of freight, the Commission estimates, entered or left the Port of New York in 1914 by water. This figure if correct is 60 per cent of that for the rail tonnage for the same year, as recorded in the preceding chapter. The precise percentage, for reasons that will be set forth, may differ materially from that indicated; but in any event the water tonnage, as was to be expected, is comparable in importance with the rail tonnage.

The almost total dissimilarity between steamship and railroad methods of administration and record keeping made it necessary to follow entirely different courses in the study of existing conditions. Instead of twelve railroad companies of fixed identity we have some two hundred steamship and steamboat companies of constantly changing identity. Instead of ownership and direction within the United States, we have it in many instances in foreign countries. Instead of record keeping in accordance with rules prescribed by Federal and State governmental bodies, we have a freedom restricted only by international rules and certain local requirements. Instead of a single Railroad Administration authorizing the Commission to go minutely into the railroads' tonnage and cost records, we have the two hundred individual steamship companies with various attitudes toward the Commission, but almost all inclined, for good reasons influenced by keen competition, to guard such records as they have. Instead of figures for actual tonnages of freight moved, kept by the railroads themselves, we have only the cargo-carrying capacities of the ships, kept by the United States Custom House for quite another purpose than to measure tonnage moved. Instead of records of all railroad tonnage, we have almost a total absence of data of even the vessels plying in certain important branches of water transportation — the Long Island Sound and the Hudson River trade.

Thus the dissimilarity of the records is almost complete. That of the operating methods is hardly less so. The railroad companies carry their freight in about a half dozen fairly standardized types of cars, hauled by locomotives over standard-gage tracks. The steamship companies bring into the Port hundreds of types of vessels, of all sizes and shapes. Railroad cars are loaded and unloaded day in and day out by a small number of methods, and although railroad terminal operations are more complex at New York than at any other port, all of the common operations can be described within a reasonable compass. Steamships (and sailing vessels) are of so many types, with such variations in number, size and location of hatches and tackle, and so wide a range of trade demands, that the discharging and reloading of each ship is something of a problem unto itself, and any attempt to select and describe the most prevalent methods of procedure is fraught with the danger that the exceptions may be more numerous than the rules.

II — AIMS AND METHODS OF STUDY

There were four principal aims in the study of shipping, as follows:

1. To obtain data as to the number and character of vessels transporting freight into or out of the Port of New York in an extended period, and the amount of cargo transported.
2. To learn as much as possible about the performances in port of typical ships, including active and idle time of the ships as a whole and of its individual hatches or ports, and methods, rates and cost of discharging and loading cargo.
3. To examine the performances at typical piers in similar detail — as to number of ships and amount of cargo handled in a given period.
4. To derive information as to preponderating commodities and character and dimensions of packages.

Five general lines of study were followed: (1) Listing of companies doing business between New York and the various parts of the world; (2) collection and study of custom-house records for a period of thirteen years with supplementary study of other governmental records; (3) clockings and cost analyses of the discharging and loading operations of seven vessels in as many classes of trade; (4) minute analyses of performance records placed at the disposal of the Commission covering business in many parts of the world; and (5) tabulation from the daily maritime news service for a period of months of the movements of vessels into and out of port to determine their length of stay in port.

Listing of Facilities

The outstanding distinction between the plant of a steamship company and that of a railroad company is that whereas the railroad company, except as it may acquire trackage rights from or make traffic agreements with other companies, must confine its land operations to its own rails, the steamship company is bound to no such limitations on the high seas. Consequently the steamship company's facilities for doing business cannot be as readily catalogued as can those of the railroad company. The steamship company may have a large fleet whose ships go to many ports of the world, only a few of which are in the New York trade; or the company may operate only tramp vessels, such vessels coming to New York at quite irregular intervals as traffic offers. Many of the ships themselves are not owned by the companies that operate them, but merely chartered for particular voyages.

At the Port of New York there are as previously mentioned about two hundred steamship and steamboat companies doing business. Only a comparatively small percentage of the waterfront and other property they occupy is owned by them. What may be considered the permanent occupancy of individual companies ranges from part of a single pier to several groups of piers in different parts of the harbor, in addition to which many companies, to take care of wide fluctuations in their volume of traffic, arrange for berthings at piers owned or leased by other companies. The identities of the companies are frequently changing, the changes having been especially numerous since the beginning of the war.

Under the circumstances it has been considered desirable merely to list as many as possible of the companies serving each of the trade zones, and to state in general terms the voluntary assignment of certain parts of the waterfront of the Port to certain zones and classes of trade.

Custom-House and Other Government Records

Drawing off and analyzing the custom-house records involved a procedure analogous to the study of railroad tonnages, except that the figures were all at one point instead of scattered among a large number of railroad offices. The actual number of records examined was possibly as great in the one case as in the other. The records, like those of the railroads, were not in precisely the form desired for this investigation, and there had to be a continuous process of selection.

Drawing off the records consumed the time of two men for a period of weeks, and the work of assembling and analysis took equally long in the engineer's office. The data for total tonnage cover each month from 1907 to 1919 inclusive. For four years — 1913, 1914, 1918 and 1919 — the tonnages are subdivided by countries.

Considerable effort was spent to locate some agency which collected data leading to a knowledge of the total aggregate movement of all goods moving into and out of New York Harbor by water, but it became evident finally that no such agency existed and that of the few that did record information of this general nature the United States Division of Customs was the most reliable and could supply a greater percentage of the total desired than any of the others.

The United States Government requires all vessels engaged in the foreign trade to submit to the customs authorities entrance and clearance papers. This includes American ships as well as foreign. In addition, any vessel having in her hold cargo that originated in a foreign country which has not yet been appraised by customs officials in order that the proper import duties may be levied is also required to submit documents listing her cargo. This in turn secures the listing of a goodly number of vessels moving coastwise carrying goods that are being transshipped between American ports. It is these requirements, therefore, that constitute the basis for the records from which the figures herein are derived.

LIMITATIONS OF CUSTOM-HOUSE RECORDS

While the customs figures have great virtue in their extent and accessibility, they present several shortcomings when the attempt is made to apply them to this analysis of the Port of New York. One of these is the fact that the statistics are for an area much larger than that which comprises the local Port of New York. As defined in the customs regulations of the United States Treasury Department for 1916, the New York District consists of twenty-six counties in the State of New York and eight in the State of New Jersey, embracing Albany, all of northern New Jersey and southeastern New York State to the Delaware River, and all of Long Island. This district has six so-called ports of entry — New York, Albany, Patchogue, Greenport, Perth Amboy and Newark — at each of which a customs officer is stationed with authority to enter and clear vessels and collect duties on imports.

Extensive as is this area and numerous as are its ports of entry, probably 95 per cent of the tonnage recorded in the district is handled at the New York port of entry alone, which comprises most of the local Port of New York. No area is actually defined in the customs regulations for any of the ports of entry, and the territory that each covers is arbitrarily determined from time to time for the purpose of patrolling the waterfront to prevent smuggling. A man entering a cargo of imported goods may have his ship papers recorded at any of the ports of entry within the district. It usually happens to be the one nearest the vessel or his bonded warehouse, which is in the neighborhood of New York Harbor. Hence the figures are believed to reflect foreign tonnage movements for the Port of New York rather completely and also give a fair idea as to part of the coastwise movement.

Another shortcoming of the customs statistics as regards their use in this investigation is that only such vessels as are moving in the foreign trade or carrying foreign goods under bond in the coastwise trade are required to be recorded.

Merely to provide their owners or operators with a public record of their movements to establish evidence as to the relative position of the ship on its route in case of mishap or disaster, and thereby make secure the insurance due, a large percentage of the vessels carrying exclusively domestic goods between New York and other coastwise ports are voluntarily registered at the custom-house.

The third and most disconcerting limitation of the custom-house figures is the fact that the amount of the cargo is not given, and only the net tonnage of the vessel is available, which is an index of the space in which cargo and passengers could have been carried. This makes it necessary to ascertain as accurately as possible the average degree of loading of all vessels, and reduce the net tonnage to cargo tons by means of an estimate.

Therefore no precise comparison can be made between the amount of freight handled in a year by the railroads and that handled by the steamships. The approximation is less inaccurate than might first appear, for the reason that each steamship represents a heavy investment and every effort is made to provide her with full cargo, whereas if she has cargo in only one direction and enters or leaves the port without cargo, the records in the case of the heaviest classified movement, the so-called "foreign direct," show her as entering or clearing "in ballast." These figures furthermore give the number of vessels that enter and clear the harbor and afford an excellent idea of the volume of shipping and the amount of berthing space necessary to accommodate it.

Customs statistics show the number and net tonnages of vessels entering and clearing the port, subdivided in part into those with cargo and those in ballast, and subdivided further into five general groups — those in the foreign trade direct, those with coastwise-in-bond cargo, those clearing via another American port, those clearing by being permitted to proceed with residue of cargo, and those clearing for non-contiguous territory. The first and second subdivisions apply only to vessels clearing.

Vessels in Foreign Trade Direct

Vessels are classified as in foreign trade direct when they enter direct from or clear direct for some foreign port. In other words, the ship's last port of call before entering or its first port of call after clearing New York must be in foreign territory. Of the total figures obtained from customs, this is easily the predominant class, and it is thought to represent a volume equal to about 50 per cent of the aggregate total of the salt-water traffic. A vessel may, however, be in this class entering and another clearing, or vice versa.

For each of four years, as previously stated, this movement is subdivided into the countries of origin and destination. Instructions by the Treasury Department for such separation, in effect since 1901, read as follows:

> "To secure uniform and correct returns of tonnage, collectors of customs, in tabulating clearances of vessels for foreign ports, will credit the tonnage to the first foreign port at which the vessel will enter for discharge of cargo, as shown in the clearance paper; but if the bulk of the cargo is to be discharged at some other foreign port, the tonnage will be credited to that port. In the case of entries, the first foreign port from which the vessel sailed with cargo for the United States is that to which the entered tonnage will be credited in the collector's returns; but such credit will not govern necessarily in the collection of tonnage tax or the requirement of bills of health."

With these instructions in effect, it is evident that some cargo destined for the smaller ports is credited to the larger ports. This applies especially to the vessels in liner service. Tramp vessels reflect more accurately a proper distribution.

A still less accurate picture of the entering tonnage by countries of origin is portrayed, because the entire amount of cargo in the vessel's hold is credited on the records as having for its point of origin the first port of departure. If a ship leaves India for New York with a few tons of cargo and stops at Suez and Gibraltar to complete the larger part of her loading, the entire cargo is credited to India.

Inasmuch as the tramp steamer during the years for which the figures were obtained has been the major vehicle for high-seas movement the world over, and inasmuch as the business done in the outlying regions of the world by New York, though large in volume, is relatively small compared to the total — and to that in and around the Atlantic Ocean basin — the figures give an excellent index in the rough of New York's foreign trade, provided stress is laid not on actual quantities but on proportions various regions enjoy of the total business.

Vessels with Coastwise-in-Bond Cargo

The most difficult category to analyze is that of vessels with coastwise-in-bond cargo. What proportion of the total number of ships the non-bonded vessels voluntarily entered constitute has not been ascertained. With great labor it could be extracted from the original records, but not within a period of time commensurate with its value.

Ship Moored Alongside Navy Base Pier in Brooklyn

Vessels *clearing via another port* are those either in ballast or with a partial cargo bound for some other American port to complete loading or obtain a full cargo before departing for a foreign port.

Ships *clearing by being permitted to proceed with residue of cargo* are on the other hand ships with cargo remaining for other ports after the New York cargo has been discharged.

Ships *clearing for non-contiguous territory* are those plying to and from the protectorates of the United States, such as Hawaii, the Philippines and Porto Rico. The nature of those operations is foreign, but they are classified as coastwise. Their total tonnage is only a very small percentage of the total.

Vessels clearing via another American port and those permitted to proceed with residue of cargo, as well as a large percentage (theoretically all) of the vessels designated as with coastwise-in-bond cargo, should be added to the foreign-direct movement to ascertain the total of ships handling exports.

Interior of Upper Deck of Manhattan's Most Modern Pier

Unrecorded Coastwise, Sound and River Movement

To arrive at the unrecorded coastwise movement a comparison was made between the entries for the lines engaged in the purely domestic coastwise trade and the known sailings of the same lines for the same period. It was found that during the year best covered by the records (1919) practically every sailing of the five principal coastwise lines was voluntarily recorded. This test was taken as evidence that the unrecorded coastwise movement with respect to clearances is only a small percentage of the movement recorded as coastwise-in-bond.

The foregoing applies only to the "open sea" coastwise movement. The Long Island Sound traffic comes in a different category. Here we have no data as such in customs as to the movement of the vessels, but we have other Government figures showing the weight of cargo during certain years. As to Hudson River traffic, no information is obtainable except with respect to the small percentage of goods shipped from tidewater for points on the canals of New York State.

Estimates of Cargo Tonnage

The tonnages of vessels entering and clearing the Port were thus largely but by no means wholly matters of record. When it came to the tonnages of cargo the problem became almost entirely one of estimating, in which many factors had to be assumed. Where, as in most cases, the basic data were the capacities of the ships, account was taken of the percentage of ships moving in ballast, the relative percentages of passenger ships and freight ships, the percentages of cargo space on passenger ships and on freight ships, the probable degree to which the space was utilized in each class of ship, the average relation of weight to volume for the cargo in different classes of trade, and other factors. To the figures derived by these estimating processes were added those derived from the actual records of cargo tonnages. Although the long ton (2,240 lb.) is the common unit in shipping practice, the quantities have been reduced to short tons (2,000 lb.) to make them comparable with the railroad tonnages.

To arrive at the most recent performances least affected by the war, and at the same time have figures comparable with the railroad figures, the year 1914 was selected for the study. The estimates are derived from clearances from the Port. Ships and cargo entering the Port present still greater problems, and the Commission found it impossible to make a satisfactory estimate of them in the time available.

Clockings and Cost Analyses

Clockings of cargo transfer operations, comparable to the clockings of railroad facilities, were made of nine ships selected to represent characteristic classes of trade or distinguishing features of size or design of vessel. In most instances the entire transfer operation was followed through from the beginning of discharging to the

Interior of Lower Deck of Manhattan's Most Modern Pier completion of loading. In addition to the records of time, tonnage transferred and men employed thus obtained, as much information as possible was secured from the steamship company officials with respect to wage scales and other matters bearing on the cost of operation. It was not feasible as in the case of the railroads to have the statistical department go minutely into the steamship companies' records, but by means of the basic cost figures obtained at the piers, an analysis of direct operating costs was made comparable in accuracy to the figures under the heading of "Direct Costs" in the railroad cost analyses.

VESSELS CLOCKED

The nine vessels clocked may be briefly described as follows:

1. A ship with a net tonnage of 1,079 tons, engaged in the trade between New York and Venezuela and hereinafter designated as the *V*; a ship with three hatches, bringing coffee, sugar and miscellaneous freight to a pier without railroad tracks, and carrying away miscellaneous cargo for two ports in Venezuela and two enroute.

2. A ship with a net tonnage of 2,948 tons, employed in the trade between New York, Cuba and Mexico and hereinafter called the *M*; a coastwise ship with four hatches and two side ports, bringing miscellaneous freight to a pier without railroad tracks, and carrying away miscellaneous cargo for Havana, Progreso, Vera Cruz and Tampico.

3. A gulf liner with a net tonnage of 4,055 tons, plying between New York and Galveston and hereinafter referred to as the *G*; a modern oil-burning steel freighter with a high ratio of net to gross tonnage, having five large hatches, eleven winches and twelve side ports, all making for a rapid discharge or intake of cargo; discharging performed at one pier and reloading at an adjacent pier, both without railroad tracks.

4. A transatlantic liner of 15,638 net tons, plying between New York and Liverpool and hereinafter called the *L*; a fast vessel with seven hatches, built to carry both passengers and freight, but arriving in ballast on this occasion, docking at a pier without railroad tracks and receiving a miscellaneous cargo, a considerable part of which was meat brought to the ship on lighters and car floats.

5. A ship of 743 net tons plying between New York and Colombia, hereinafter called the *H*.

6. A ship of 1,617 net tons in the trade between New York and Porto Rico, referred to as the *E*.

7. A ship of 4,077 net tons in the trade between New York and Porto Rico, referred to as the *F*.

8. A Long Island Sound freighter, referred to as the *D*.

9. A Long Island Sound passenger steamer, referred to as the *B*.

In the case of all of these ships the transferring was done by means of ship's tackle, with or without the assistance of cargo masts on the pier side and lighter derricks on the offshore side. A large part of the transferring was done by lighters. During one operation the ship was breasted off for the receipt of bunker coal, and the opportunity was afforded both to clock the coaling operations and to observe the effect of the bunkering on the general cargo transferring work.

FOUR OPERATIONS IN CARGO TRANSFER

Before the clockings were begun preliminary analyses were made of the operations of discharging and loading cargo so as to separate and bring out each component movement in the process. It was concluded that there were ordinarily four in discharging and four in loading. In the discharging of cargo the operations are as follows:

1 — *Breaking Out*, which involves the work of moving the freight from its place in the ship's hold to the net or sling to which the ship's tackle is hooked.

2 — *Hoisting*, which embraces hooking the ship's tackle to the loaded sling or net, raising the load from the hold, moving it over the ship's deck, lowering it to the deck of the lighter or the floor of the pier or transferring it to the hook of another tackle, unhooking the ship's tackle and returning it to the hold of the vessel. Where the freight does not pass through a hatch but is trucked from the hold through side ports to pier or lighter the hoisting operation disappears.

3 — *Trucking or Carrying*, which includes trucking the freight by hand or power truck or the movement of it by any other means, such as on the backs of carriers, from the place of its deposit by the ship's tackle to the point where it is to be stowed, and the return of the empty truck or the carrier to the point for receiving the next load.

4 — *Stowing*, which involves placing the freight on the pier or lighter, including any necessary tiering.

The four stages in loading are as follows:

1 — *Breaking Down*, which involves moving the freight from its place of storage on the pier or lighter to a hand or power truck, or to the ship's tackle if the freight is so situated that no intervening movement is necessary.

2 — *Trucking or Carrying*.

3 — *Hoisting*. Trucking, carrying and hoisting may be defined as in discharging, except for the reversal of the direction of the load.

4 — *Stowing*, which in loading means the placing of the cargo in position in the hold of the ship.

ORGANIZATION OF THE CLOCKINGS

Substantially the same organization previously employed in the railroad clockings made the steamship clockings. Aside from several men making advance surveys and planning the clockings, a force of twenty-four men was used, divided into eight-hour or twelve-hour shifts. The number of men and working hours per shift depended on the hours the work under observation continued, which were more or less variable because of weather and other conditions.

As it was necessary to do the clocking without delay to or interference with the normal work of transferring cargo, one of the extra men visited each pier before the arrival of the ship to be clocked in order to obtain any information which might facilitate the clocking. He also visited the offices of the steamship companies and obtained information as to rates of pay for labor, prices paid for coal, details of pier overhead cost and other facts pertinent to the study. Hearty co-operation was accorded the Commission's force by most of the steamship officials encountered.

CHARACTER OF INFORMATION RECORDED

Forms were prepared for recording the time and labor consumed by each movement or step in the operations. For recording the flow of cargo through each hatch — the result of the time and labor expended — forms were used on which the tonnages discharged or loaded could be rapidly noted. Special forms were employed for recording certain data on the work of lighters engaged in the transfer, and others for the analysis of coaling operations.

A member of the force was stationed at each hatch or side port to record the operations through or at it. At such points the following data were noted:

Location of hatch or port with respect to ship and to pier.
Time hatch or port began and ceased to be operated.
Number of slings per hour through hatch or trucks per hour through side port.
Character and weight of freight in each sling or on each truck, and number of pieces.
Distances freight was trucked or carried on pier or lighter or in hold.
Idle time and reasons therefor.

The records were so taken as to separate the operations between ship and lighter from those between ship and pier.

In the case of lighters, the following information was obtained:

Name, type and owner of lighter
Origin and time of leaving same
Commodity and weight at origin
Location of intermediate stops
Commodity and weight loaded or discharged at intermediate stops
Time consumed at each stop
Time of arrival at steamship pier
Time loading or discharging started
Commodities and weights loaded or discharged
Idle time and reasons therefor
Method used in breaking down or storing freight on lighter
Method of loading from or discharging to ship
Number of men in crew regularly employed on lighter, and wages received
Number of extra men employed
Time loading or discharging was completed
Time lighter departed

The hatch or port records showed the number of slings or hand trucks used to move the freight, and the weight and number of pieces in each sling or on each truck.

The men on patrol assignments were specially instructed to keep track of the time consumed and the number of men engaged at all times in each phase of each operation — a task requiring alertness because of the frequent shiftings of gangs or individual men in gangs.

The records when completed showed the time of beginning and terminating work at each hatch and on each lighter, the idle time and reasons therefor and the time gang shifts from place to place were made. For each hatch it showed the number of men engaged in breaking out, hoisting, trucking or carrying, and stowing, and also the number of hours during which the men were so engaged. A further record was kept of the general labor employed, such as pier foremen, stevedores, hatch bosses, coopers, watchmen, riggers, cargo selectors, tallymen and timekeepers.

The following information was obtained with respect to coaling operations:

Name and owner of coal barge
Point of origin
Tonnage loaded at origin
Time of loading
Time of departure from origin
Location of intermediate stops
Tonnage unloaded at each point
Time of arrival at pier
Waiting time
Time coaling started
Idle time and reasons therefor
Time barge stopped coaling
Tonnage unloaded to vessel
Time barge left ship's side
Number of men engaged in the operation, with their duties and rates of pay

A description of the mechanical appliances used and method of coaling was also prepared. The steamship companies gave figures showing the amount of coal in the ship's bunkers when the vessel arrived in port, the amount consumed in voyage and that consumed in port.

OFFICE ANALYSIS

The office work involved in the cost analyses consisted of the translation of number of men employed and time consumed to hatch-hours, man-hours and labor costs, and the dovetailing of the observations made at each hatch and on each lighter to make a picture of the performance of the ship as a whole.

This interpretive study was confined in the main to two of the ships, the *V* and the *M*. Time was not available for full analyses of the remaining seven, but partial analyses were made and valuable inferences drawn.

Study of Available Performance Records

The custom-house records, while giving the best information obtainable as to the number and tonnage of ships entering and leaving New York Harbor, shed no light on the time of turnaround, the costs of discharging and reloading, the character of commodities handled, the volume of traffic over any one pier or the performances of the piers. Useful information along these lines was obtained from the clockings. These covered only nine ships, however, in a total of upward of 4,000 per year, and the desirability of other data along the same lines was apparent. The opportunity for obtaining such data was offered by the records already mentioned of the steamship companies themselves.

With respect to these records, which covered a great variety of phases of steamship terminal operations and were made for purposes quite apart from this investigation, the Commission's representatives were confronted with the task of selecting such as were the most illuminating for the problem in hand. There were certain objectives — information as to pier performances, information as to the performance of ships at piers with respect to discharging, loading and the like, information with respect to all operations of the ships in port and information as to the commodities handled. The analysis was therefore classified along these lines.

STEAMSHIPS

Twenty-six freight steamships in the African, Brazilian and so-called "Eastern Ocean" trade (Asian and Australasian), operating into and out of the harbor in 1913, the latest year uninfluenced by the war with respect to shipping, were selected for study. In this respect they are designated, according to the countries or regions to and from which they applied, as the ***Africa* 1, 2, 3**, and ***4***, the ***Brazil* 1, 2, 3, 4, 5, 6, 7** and **8**, the ***China* 1, 2, 3, 4, 5** and **6**, the ***India* 1, 2, 3, 4, 5** and **6** and the ***Java* 1** and **2**.

Of these twenty-six ships nine were in turn chosen for more detailed analysis, the nine being thought to offer the most promise in the way of instructive information. The nine and their net registered tonnages are as follows:

China 1	2,600	*Java 2*	2,640	*Java 1*	2,743
India 1	3,554	*Brazil 1*	2,310	*Brazil 7*	2,713
Africa 2	3,113	*Africa 3*	3,153	*Brazil 4*	2,312

Piers

Four piers were also chosen for special analysis. They were chosen because of the availability of the records in more or less convenient form rather than because of their physical characteristics. Nevertheless they may be regarded as typical piers.

These piers may be known as Piers 501, 601, 602 and 603, which numbers are not the real numbers of the piers. Pier 501 is a single-story pier in Brooklyn. Piers 601, 602 and 603 are all two-story piers in Manhattan. Large miscellaneous cargoes were handled over the decks of all of the piers, none of which were used exclusively for special commodities. Certain special commodities such as grain in bulk were delivered to the vessel direct from the slips. The upper decks of the Manhattan piers were used for freight service only to a very limited extent.

Shore End of Navy Base Pier at Thirty-ninth Street, Brooklyn

It it not contended that the analysis of individual performances is complete. The shipping operations within the Port are far too numerous and varied to make it possible to draw positive conclusions from the records of any four piers. At the same time the Commission believes that readers of the report will find the results of the analysis instructive, and will see in them one of the important functions of a permanent port authority, that of continuously collecting and dissecting such records as these.

Maritime News Records of Turnarounds

The fifth phase of the study of shipping operations was derived from the maritime news published in certain New York newspapers. These newspapers were drawn upon for the date of arrival and date of sailing of ships going to all parts of the world, and from these dates the period in port was determined.

Steamers having such net tonnages (determined from Lloyd's Register of Shipping) as to suggest that they were typical cargo carriers were used exclusively, the attempt being made to account for at least sixteen in each of the various world shipping zones. The full number was not obtained in every case, and for certain zones the records were so inadequate that no average was attempted.

These sources of information are neither thoroughly accurate nor thoroughly complete, but the inferences that may be drawn are suggestive and of value in the general study of the subject.

III — STEAMSHIP COMPANIES AND FACILITIES

A recent count showed 241 steamship and steamboat companies maintaining offices in New York City. Not all of these companies operate vessels into and out of the Port. On the other hand some of the large German companies doing business at the Port before the war are not included in the list. It is probable, therefore, that the figure of 200 companies operating ships into and out of the Port is not far from correct.

These companies, as previously pointed out, vary from organizations maintaining large fleets and doing business over a large part of the world to companies with a single vessel. Some of the companies operate as many as four piers regularly and still require berthing space from time to time at whatever additional piers can accommodate them. Many others get along with one pier, and may share the one pier with other companies.

Some of the companies operate their vessels on regular schedule. A large number, however, of those handling freight only have sailings according as the cargo is available and can be handled. Some of these latter operate regularly between certain ports, while others in the tramp service send their ships wherever they find cargo.

Waterfront Zones as Established by Custom

Convenience and custom have established certain fairly well defined locations for different kinds of trade. Because of the wide waterways and freedom from reefs and the convenience to the metropolitan center and the railroads, the transatlantic passenger liners have located mostly in the Hudson River well up from the Battery, on both sides of the river. Below this transatlantic section on the Manhattan side such of the coastwise and Sound liners as bring a considerable amount of foodstuffs compete with the railroads for space adjacent to the primary food market, other competitors for the much-sought space being the Hudson River lines, to which this space is convenient from both the passenger and freight point of view.

On the East River side of Manhattan are found other coastwise and Sound lines, as well as lines for the West Indies and Central and South America and one or two transatlantic lines. The Brooklyn waterfront is used chiefly by freighters, to which accessibility to warehouses is more important than convenience to passengers. Many of these companies lease piers owned by one or another of the various private companies on the

Brooklyn waterfront. The Staten Island waterfront, so far as it is developed — this being limited to a small section along the northeastern part of the island — is utilized in about the same manner as the Brooklyn waterfront. A twelve-pier development is well under way by the City of New York in this section.

On the New Jersey side, aside from the transatlantic piers previously mentioned, which are in Hoboken and Weehawken, the developed waterfront along the Hudson River and the Upper Bay is mostly in the control of the railroads, which maintain a certain number of piers for the direct transfer of heavy pieces direct between cars and ships, and a large number of lighterage piers at which ships do not dock. There are also several grain elevators at which ships can dock.

Developments in recent years along Jamaica Bay and along Newark Bay in Newark offer facilities, not much used as yet, for freighters requiring warehouse and rail facilities. Elizabeth, Perth Amboy, Edgewater, the Bronx and Yonkers have a few scattered facilities for shipping of one sort or another.

Companies in the Various Trades

Later on in this chapter certain of the custom-house records of ships entering and clearing the Port of New York are segregated by world zones. These zones were arbitrarily designated by the Commission, but the intent has been to make them conform to trade routes established by custom. They are as follows:

1. United Kingdom and Europe Proper.
2. Mediterranean.
3. Africa — West, South and East Coasts.
4. India.
5. Far East — East Coast of Asia.
6. East Indies and Australasia.
7. South America — North and East Coasts.
8. South America — West Coast.
9. West Indies and Central America, East Coast.
10. Miscellaneous Atlantic.
11. Miscellaneous Pacific.

In addition there is Atlantic coastwise traffic, mostly domestic, and North American coastwise traffic.

There follow nearly, it is believed, but probably not quite all of the companies doing business between New York and the various zones.

United Kingdom and Europe Proper — Zone 1

Baltic Steamship Corporation.
Barber & Company, Inc.
Bristol Line.
Cunard Steamship Company, Ltd. (Cunard, Anchor and various freight lines).
Federal Steamship Line.
France & Canada Steamship Corporation.
French Line.
Furness, Withy & Company, Ltd. (Prince Line).
Gaston, Williams & Wigmore Steamship Corporation (Globe Line).
Hamburg-American Line (Not in operation since the war).
Harriman Lines.
Holland-America Line.
International Mercantile Marine Company (White Star, American, Red Star and Atlantic Transport Line to and from New York).
Lamport & Holt, Ltd.
Luckenbach Steamship Company, Inc.
North German Lloyd Line (Not in operation since the war).
Norton, Lilly & Company.
Norwegian-American Line.
Scandinavian-American Line.
Swedish-American Line.
U. S. Mail Steamship Company.
Ward Line.

Mediterranean — Zone 2

Barber & Company, Inc.
Compagnia Transatlantic (Spanish Line).
Cunard Steamship Company, Ltd.
Cyprien Fabre & Company.
France & Canada Steamship Corporation.
Furness, Withy & Company, Ltd.
International Mercantile Marine Company.
Navigazione Generale Italiana (Italian Line).
Sicula-America (Pierce Line).

Africa — Zone 3

Barber & Company, Inc. (Union Clan Line and others).
Funch, Edye & Company.
Robert P. Houston & Company, Inc.
Wardrop West African Steamship Company.

India, Far East and Australasia—Zones 4, 5 and 6

American Asiatic Steamship Company.
Barber & Company, Inc.
Commonwealth & Dominion Line.
Funch, Edye & Company.
W. R. Grace & Company.
Norton, Lilly & Company.

South America — Zones 7 and 8

Atlantic & Caribbean Steam Navigation Company (Red "D" Line).
Atlantic Fruit Company.
Barber & Company, Inc.
Booth & Company.
Funch, Edye & Company.
Furness, Withy & Company.
Gaston, Williams & Wigmore Steamship Corporation.
W. R. Grace & Company.
Robert P. Houston & Company.
Lamport & Holt.
Lloyd Braziliero.
Luckenbach Steamship Company.
New York & South American Steamship Company.
United Fruit Company.
United States & Brazil Steamship Company.
Wessel, Duval & Company (West Coast Line).

West Indies and Central America — Zone 9

The list includes a number of the companies mentioned in the South American trade, many of whose vessels touch at West Indian points on the way to and from South America, and in addition the following:

Atlantic, Gulf & West Indies Steamship Lines, including the
  Clyde Steamship Company,
  New York & Cuba Mail Steamship Company (Ward Line).
  New York & Porto Rico Steamship Company.
Munson Steamship Line.
Panama Railroad Steamship Company.
Quebec Steamship Company.
Royal Mail Steam Packet Company.
Trinidad Shipping & Trading Company, Ltd.

Zones 10 and 11, Miscellaneous Atlantic and Miscellaneous Pacific, are covered in the main by the preceding lists covering North and South America, and it is difficult to make further separation. There remain certain companies which operate tramp vessels chiefly, and the large number of companies in the domestic coastwise, Sound, river and local salt-water service.

Companies Operating Tramp Vessels Chiefly

Cosmopolitan Line.
Bull-Insular Line, Inc.
Kerr Steamship Company.

DOMESTIC COASTWISE SERVICE

Atlantic, Gulf & West Indies Steamship Lines, including the
  Clyde Steamship Company,
  Mallory Line.
Ocean Steamship Company (Savannah Line).
Southern Pacific Steamship Lines (Morgan Line).

SOUND SERVICE

Central Railroad of Vermont (freight service to New London.
Colonial Line.
Eastern Steamship Lines, Inc. (Metropolitan Line).
Hartford & New York Transportation Company (Bay State Line).
New England Steamship Company, consisting of:
  Fall River Line.
  Providence Line.
  New Bedford Line.
  New Haven Line.
  Bridgeport Line.
Starin Transportation Company.
Other Sound and local salt-water lines, including:
  Charles W. Davis Line.
  New York & New Jersey Steamboat Company.
  North & East River Transportation Company.
  Port Chester & New York Transportation Company.
  Newark Line.
  Red Bank Line.

HUDSON RIVER LINES

Catskill & New York Steamboat Company.
Central Hudson Navigation Company.
Hudson Navigation Company.
Lower Hudson Line — East.
Lower Hudson Line — West.
Saugerties Line.
Troy Evening Line.
Yonkers Line.

The Sound liners and the long-distance and short-distance Hudson River vessels form a complete transition between the ocean-going ships and the inland water craft, so that no sharp line can be drawn between the one group and the other. A large part of the Hudson River traffic, particularly building materials and similar coarse freight, is towed in scows. Some of it originates at or is destined for local points on the Hudson River, some for points on the New York Barge Canal system. The Barge Canal traffic is handled either at the principal Barge Canal terminal, Piers 5 and 6, East River, Manhattan, at one of the other Barge Canal terminals (see Chapter 25) or at various piers not controlled by the large companies to the exclusion of others; the local Hudson River traffic is handled at these various common piers. Several piers for open or public wharfage (with mechanical devices) are being provided by the City of New York and are under reconstruction.

There are a number, but not enough to meet the demand, of piers where tramp or other vessels whose owners have no permanent quarters at the Port can obtain berthing.

IV — VOLUME AND DISTRIBUTION OF SHIPPING

No means has been found for determining or estimating with any degree of accuracy the water-borne traffic of the Hudson River. Exclusive of these amounts the Commission estimates that about 45,000,000 tons of cargo were moved into or out of the Port of New York by water in 1914. This compares with the 76,052,000 tons of freight handled into, out of or through the Port District during the same year by the twelve railroads of the Port.

SHIP TONNAGE TERMS

In order to understand clearly the figures that follow, and the relation between registered ship tonnage and cargo tons, it is necessary to be cognizant of various terms used in shipping parlance. There are for different purposes at least four ways of designating the capacity of a ship. They are as follows:

Displacement Tonnage — The weight of water a ship displaces in tons of 2,240 lb. This term is applied mainly to vessels whose weight during service does not change materially, such as battleships, patrol boats and the like. It is not ordinarily applied to merchant vessels.

Deadweight Carrying Capacity — The difference in tons of 2,240 lb. between the displacement of the ship when light and when fully loaded to the maximum draft allowed by law. In other words, deadweight carrying capacity is the weight in long tons of cargo, fuel, water, stores, officers, crew, passengers and their effects that can be safely carried by the ship. It is usually about two-thirds of the displacement tonnage.

Gross Tonnage — A measure of the internal capacity of the entire ship, including superstructures, in terms of approximate tons based on space. For this purpose 100 cu. ft. of closed-in space are designated as one ton. Gross tonnage is usually about two-thirds the deadweight carrying capacity or less than half the displacement tonnage.

Net Tonnage — A figure, measured in the same units as the gross tonnage, obtained by deducting from the gross tonnage allowances made for the ship's machinery, navigation and propelling space and quarters for officers and crew. The net tonnage is thus intended to be a measure of the passenger and cargo-carrying or earning capacity of the ship. It is usually about 63 per cent of the gross tonnage, which makes it less than half the deadweight carrying capacity and barely a fourth of the displacement tonnage.

The foregoing shows the great importance of an understanding as to what term is meant when the ship is referred to as one of so many tons.

Payable Tonnage — None of these tonnage figures is a direct indication of the weight of cargo in the vessel fully loaded. Cargo is in general charged for by weight or measurement according as a long ton (2,240 lb.) occupies more or less than 40 cu. ft. If it occupies less it is charged for by weight. If it occupies more its weight in tons is assumed to be the ratio of its volume to 40 cu. ft. In other words, the usual basis for the so-called payable ton is 40 cu. ft. instead of 100 cu. ft. as in the case of ship tons.

Thus a ship fully loaded with cargo measuring exactly 40 cu. ft. to the long ton would be carrying 2½ times the net registered tonnage. Because of the considerable volume of lighter goods in the average cargo it is estimated that the average full load in long tons is only about double the indicated net registered tonnage. The customs figures that follow are in terms of net tonnages, and it can be assumed that full cargoes would amount in payable tons to about double the indicated figures. In the estimates of freight moved by water 54 cu. ft. per ton for cargoes in the foreign trade and 70 cu. ft. for those in the coastwise have been assumed to be fair averages.

Plimsoll Mark — Through the efforts of Samuel Plimsoll some fifty years ago Parliamentary action was taken, as a matter of protection to sailors to prevent the overloading of ships. There was required on each ship a horizontal mark, known as the plimsoll mark, which indicated the minimum freeboard allowable, and which must remain at or above the surface of the water. There are now in fact several such marks, at slightly different levels governing different seasonal and other conditions, and they are required on all English vessels.

Full and Down — If all of the cargo space in a ship were filled with light material the ship would not be brought down to her plimsoll mark, and no advantage could be taken of revenue tons of less than 40 cu. ft. volume. The ship would be "full" but not "down." On the other hand she could be loaded with steel or other heavy material and brought down to her plimsoll mark before her space was filled, and this extra space would be useless. She would be "down" but not "full." The aim of operators is to have her "full and down"— a condition which reflects a maximum payable tonnage.

TABLE 1 — YEARLY TOTALS, IN NUMBER OF SHIPS AND IN NET VESSEL TONNAGE, FOR VESSELS ENTERING AND CLEARING THE PORT OF NEW YORK IN FOREIGN DIRECT SERVICE

	Entered						Cleared					
	Vessels			Net tonnage			Vessels			Net tonnage		
YEAR	With cargo	In ballast	Total	With cargo	In ballast	Total	With cargo	In ballast	Total	With cargo	In ballast	Total
1907	4,048	267	4,315	11,321,794	662,503	11,984,297	3,346	517	3,863	11,008,624	464,710	11,473,334
1908	3,618	393	4,011	11,123,331	1,059,820	12,183,151	3.274	456	3,730	11,405,175	397,487	11,802,662
1909	3,847	307	4,154	11,766,886	884,631	12,651,517	3,134	599	3,733	11,492,306	554,822	12,047,128
1910	3,848	301	4,149	12,405,673	935,276	13,340,949	3,204	551	3,755	12,293,964	668,745	12,962,709
1911	3,623	458	4,081	12,198,562	1,389,734	13,588,296	3,416	467	3,883	12,999,925	536,997	13,536,922
1912	3,652	443	4,095	12,715,990	1,308,952	14,024,942	3,347	403	3,750	13,331,161	498,152	13,829,313
1913	3,956	492	4,448	13,893,249	1,517,828	15,411,077	3,706	497	4,203	14,345,877	821,424	15,167,301
1914	3,773	433	4,206	12,677,769	1,216,717	13,894,486	3,478	564	4,042	12,554,047	997,430	13,551,477
1915	3,359	1,424	4,783	9,083,410	3,723,986	12,807,396	4,295	505	4,800	12,102,791	775,874	12,858,665
1916	3,738	1,454	5,192	9,499,029	3,714,890	13,213,919	4,837	551	5,388	13,074,608	768,865	13,843,473
1917	3,482	1,148	4,630	8,549,222	3,331,740	11,880,962	4,165	333	4,498	11,223,647	482,404	11,706,051
1918	2,747	1,293	4,040	6,721,104	4,661,407	11,382,511	3,426	277	3,703	10,423,380	635,634	11,059,014
1919	3,617	1,399	5,016	10,004,644	3,969,408	13,974,052	4,316	686	5,002	12,882,775	1,544,254	14,427,029

Grain Measurement — It is impossible to load any ship in such a manner as to utilize completely every cubic foot of space within her hold. The commodity which will most nearly accomplish this is grain in bulk. Grain measurement, therefore, has come to mean the entire cubical contents of a ship, the space being conceived to be completely utilized from deck to deck and from "skin to skin." This includes the space between the ribs on the sides as well as between the deck girders under the decks. It is understood, of course, that when grain is loaded this is not completely accomplished.

Bale Measurement — Because the average cargo is usually baled and packed in containers it is impossible to utilize completely the space between the ribs on the sides and between the deck girders under the decks. Furthermore, it is impracticable to stow dissimilar packages of miscellaneous cargo without waste of space between them and without making provision for space to "break them out" when the vessel is to start discharging. A measurement of the space generally utilized for baled and packed commodities is known as bale measurement. It is estimated to average about 25 per cent less then grain measurement.

Vessels in Foreign Trade Direct

Vessels in foreign trade direct constitute the great bulk of the vessels engaged in any way in foreign traffic, and in fact a large percentage of all vessels accounted for in the custom-house records. The Commission has found it possible to analyze this movement much more fully than any of the other classes. It presents the totals entering and clearing in this movement each month and each year from 1907 to 1919 inclusive, in number of ships and in net tonnage, subdivided again into ships with cargo and ships in ballast. For each of four years it allocates the movement entering and clearing to ninety-two foreign countries.

Table 1 shows the yearly total entered and cleared, in vessels and in net tonnage, with cargo and in ballast. It indicates a gradual increasing movement up to the beginning of the war, considerable depression during the war and a partial recovery in 1919.

The number of ships did not increase as rapidly as the total net tonnage, indicating a general increase in the average size of the vessels. For the entire period, however, the average was in the general vicinity of 3,000 net tons. In other words, the vessels had an average cargo-carrying capacity of about 6,000 long tons.

Although ships are built within the Port District and have been throughout the period covered by the table, it appears that considerably more vessels entered in the foreign-direct group than cleared. This is probably explained by the fact that a considerable number of the vessels indicated here as entered in the foreign trade direct cleared for one or another reason for other American ports and so show in other groups. This fact also makes it difficult to determine what percentage of ships entering or leaving the Port are without cargo, but it is evident that the percentage was rather large.

FOREIGN TRADE DIRECT BY COUNTRIES

From the classification of the foreign-direct movement by countries, the details of which are too voluminous for presentation in the report, Figs. 1–4 have been prepared showing the distribution by countries of the vessels in foreign trade direct clearing from New York in 1913 and in 1919. Figs. 1 and 2 are in terms of the number of ships; Figs. 3 and 4 in terms of net vessel tonnages.

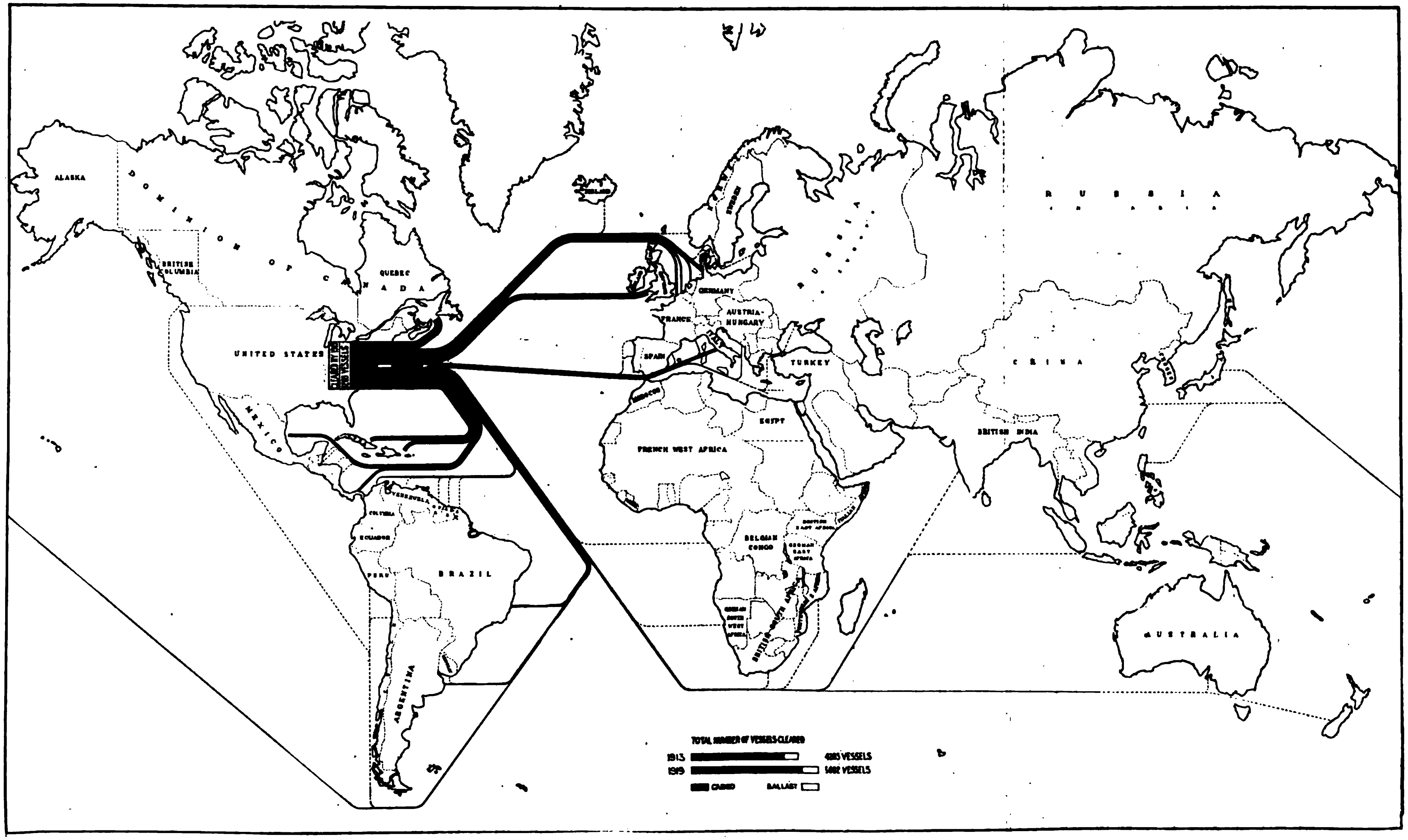


FIG. 1 — Number of Vessels Leaving New York in the Foreign Trade, Showing the Countries of Destination, in 1913

Width of stream indicates the number of ships. Where the lines are dotted the number of vessels was less than fifty. The direction of the streams follow in a general way only the major trade routes, not the path of the ship. The northern and southern extremities of the chart are widely distorted because a map on Mercator's Projection was used

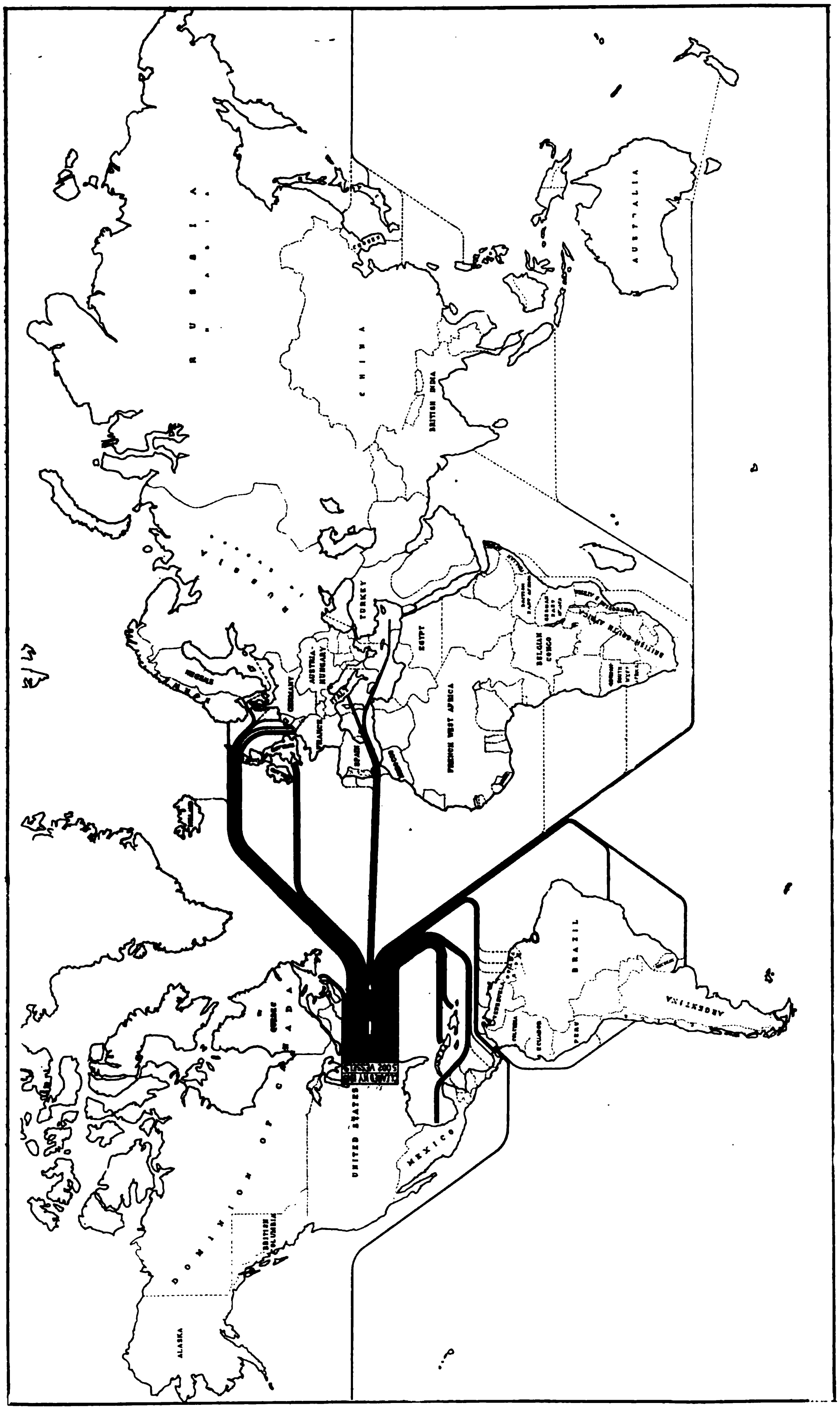


FIG. 2—Number of Vessels Leaving New York in the Foreign Trade, Showing the Countries of Destination, in 1919

Pacific Ocean trade assumed to be routed entirely through the Panama Canal since its opening

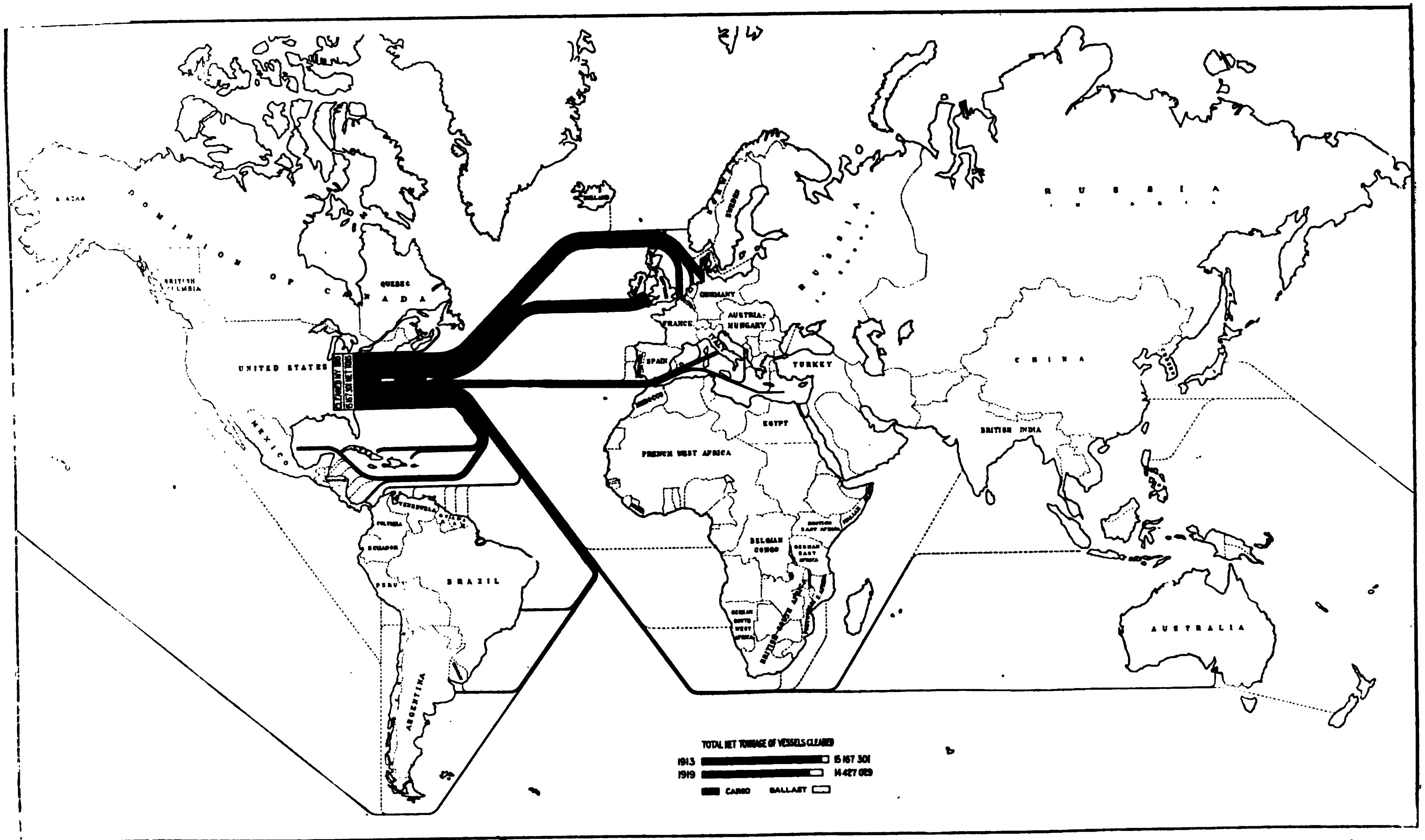


FIG. 3 — Total Net Vessel Tonnage Leaving New York in the Foreign Trade, Showing the Countries of Destination, in 1913

Dotted lines indicate that the net vessel tonnage was less than 150,000 tons

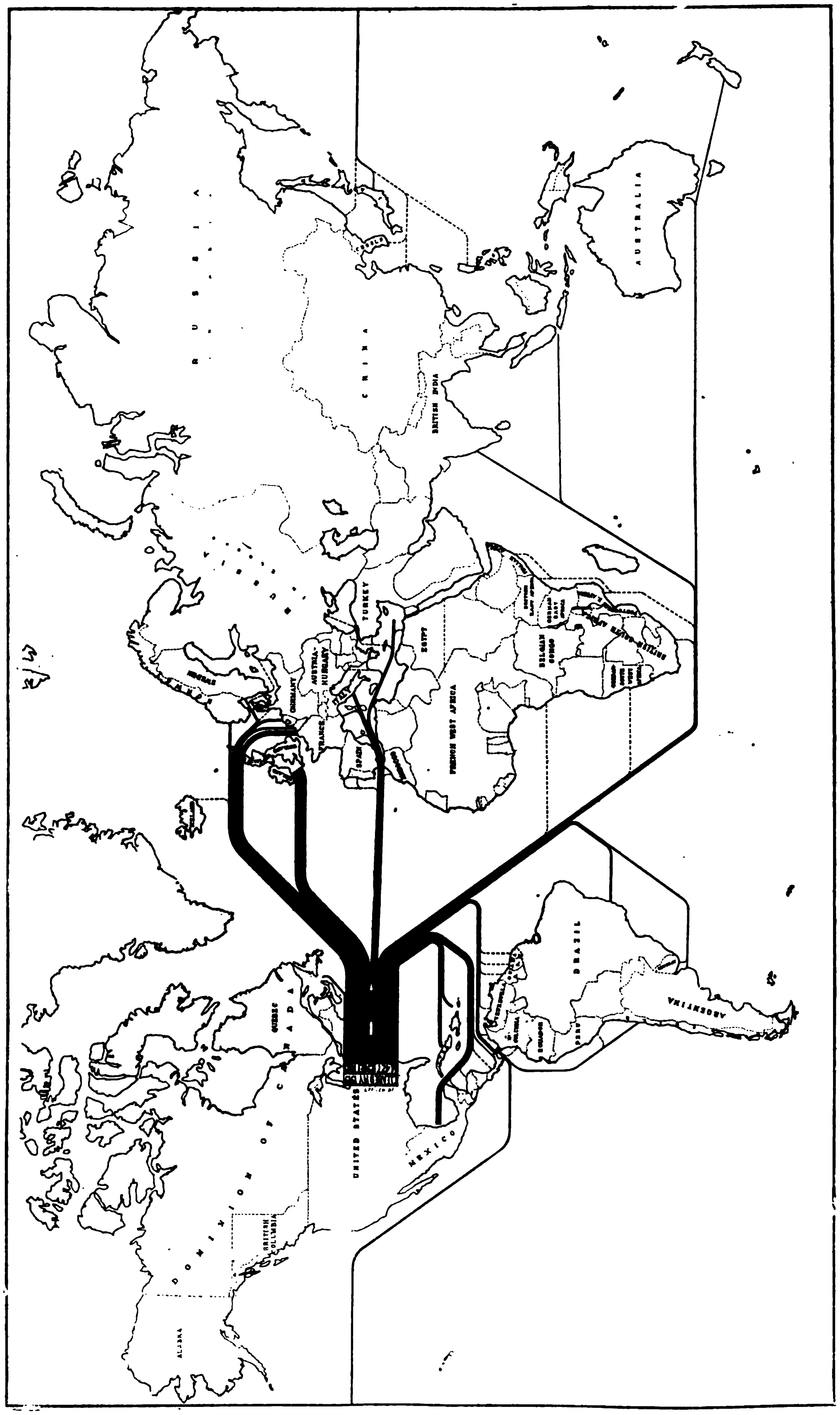


FIG. 4 — Total Net Vessel Tonnage Leaving New York in the Foreign Trade, Showing the Countries of Destination, in 1919

There are striking differences in the width of bars corresponding to number of ships and to tonnages reaching certain regions. A large number of small boats, for example, cleared for the fishing banks around Newfoundland, while a relatively small number of vessels clearing for Germany had a much greater net registered tonnage.

The years selected for the diagram were so chosen because 1913 was the last prior to the abnormal conditions caused by the war, and 1919 was the latest year available. The diagrams cover clearances only, the reason being that the customs practice shows this movement more accurately.

While for the reasons mentioned the custom-house records do not reflect with great precision the foreign direct movement to and from individual countries, they are believed to give a very close index to and from world zones. Table 2 shows this movement by such zones, eleven in number.

Zone 1, embracing the United Kingdom and Europe proper, of course heads the list in volume of tonnage. Zone 9, covering the West Indies and Central America, comes second, and the order of the other zones can readily be taken from the table.

Table 3 shows the same information for the year 1919.

TABLE 2 — ORIGINS AND DESTINATIONS BY WORLD ZONES OF FOREIGN TRADE DIRECT OF PORT OF NEW YORK IN 1913

ZONE	Entered						Cleared					
	Number of vessels			Net vessel tonnage			Number of vessels			Net vessel tonnage		
	With cargo	In ballast	Total	With cargo	In ballast	Total	With cargo	In ballast	Total	With cargo	In ballast	Total
1. United Kingdom and Europe proper	1,137	331	1,468	7,314,134	1,063,988	8,378,122	1,228	11	1,239	7,574,508	57,671	7,632,179
United Kingdom	*449*	*162*	*611*	*2,955,150*	*582,611*	*3,537,761*	*473*	*1*	*474*	*3,149,794*	*215*	*3,150,009*
Europe proper	*688*	*169*	*857*	*4,358,984*	*481,377*	*4,840,361*	*755*	*10*	*765*	*4,424,714*	*57,456*	*4,482,170*
2. Mediterranean	376	19	395	1,787,525	49,534	1,837,059	349	1	350	1,663,012	10,306	1,673,318
3. Africa — West, South and East Coasts	12	7	19	37,734	16,669	54,403	39	0	39	142,637	0	142,637
4. India	8	0	8	22,471	0	22,471	28	0	28	110,252	0	110,252
5. Far East — East Coast of Asia	14	0	14	49,093	0	49,093	77	0	77	309,298	0	309,298
6. East Indies and Australasia	1	0	1	599	0	599	75	0	75	281,951	0	281,951
7. South America — North and East Coasts	364	41	405	999,917	120,627	1,120,544	418	5	423	1,212,660	9,111	1,221,771
8. South America — West Coast	23	0	23	66,520	0	66,520	24	0	24	84,416	0	84,416
9. West Indies and Central America, East Coast	1,327	32	1,359	2,908,492	125,157	3,033,649	981	243	1,224	2,409,220	515,688	2,924,908
West Indies	*780*	*29*	*809*	*1,384,606*	*110,049*	*1,494,655*	*604*	*126*	*730*	*1,214,364*	*267,157*	*1,481,521*
Central America, East Coast	*547*	*3*	*550*	*1,523,886*	*15,108*	*1,538,994*	*377*	*117*	*494*	*1,194,856*	*248,531*	*1,443,387*
10. Miscellaneous Atlantic	694	62	756	706,764	142,453	849,217	483	237	720	542,316	228,648	770,964
11. Miscellaneous Pacific	0	0	0	0	0	0	4	0	4	15,607	0	15,607
Grand total	3,956	492	4,448	13,893,249	1,518,428	15,411,677	3,706	497	4,203	14,345,877	821,424	15,167,301

Coastwise Vessels in Bond

As has been previously stated, a large part of the coastwise movement comes directly under the jurisdiction of the custom-house because much of the cargo in the movement is of foreign origin, is yet to be appraised for the purpose of levying duties, and is under bond until released by the custom-house. And in addition to this bonded amount the officials at the New York Custom-House have incorporated into this particular record certain vessels whose cargoes are wholly free from duty, being exclusively domestic goods in transit between New York and other domestic ports. One of the reasons given for the voluntary registry of such vessels, as previously stated, is that their owners or operators desire to have a public record of their movement in case of fire or shipwreck.

Aside from this non-bonded movement, the coastwise-in-bond entrances may be ships proceeding to New York with imports, after discharging parts of their loads at other American ports; ships partly loaded on outbound voyages at one or more other ports and proceeding to New York to complete or continue loading of exports; or domestic ships in the coastwise trade bringing foreign goods in bond transferred to them at other ports from vessels not touching New York.

TABLE 3 — ORIGINS AND DESTINATIONS BY WORLD ZONES OF FOREIGN TRADE DIRECT TO PORT OF NEW YORK IN 1919

ZONE	Entered						Cleared					
	Number of vessels			Net vessel tonnage			Number of vessels			Net vessel tonnage		
	With cargo	In ballast	Total	With cargo	In ballast	Total	With cargo	In ballast	Total	With cargo	In ballast	Total
1. United Kingdom and Europe proper	853	1,050	1,903	4,101,148	3,178,684	7,279,832	1,764	4	1,768	6,607,885	44,615	6,652,500
United Kingdom	*394*	*448*	*842*	*2,255,493*	*1,579,958*	*3,835,451*	*514*	*4*	*518*	*2,793,736*	*44,615*	*2,838,351*
Europe proper	*459*	*602*	*1,061*	*1,846,655*	*1,598,726*	*3,444,381*	*1,250*	*0*	*1,250*	*3,814,149*	*0*	*3,814,149*
2. Mediterranean	365	209	574	1,215,601	563,031	1,778,632	550	6	556	1,700,208	6,049	1,706,257
3. Africa — West, South and East Coasts	60	10	70	99,077	20,705	119,782	101	0	101	255,243	0	255,243
4. India	26	0	26	83,145	0	83,145	44	0	44	162,340	0	162,340
5. Far East — East Coast of Asia	23	0	23	91,921	0	91,921	132	0	132	500,238	0	500,238
6. East Indies and Australasia	21	0	21	80,734	0	80,734	106	0	106	403,702	0	403,702
7. South America — North and East Coasts	505	7	512	1,046,992	8,923	1,055,915	514	16	530	1,247,138	26,379	1,273,517
8. South America — West Coast	48	2	50	120,207	7,198	127,405	61	10	71	177,314	33,435	210,749
9. West Indies and Central America, East Coast	1,454	20	1,474	2,928,714	42,018	2,970,732	807	522	1,329	1,636,293	1,278,570	2,914,863
West Indies	*948*	*15*	*963*	*1,317,596*	*27,628*	*1,345,224*	*587*	*231*	*818*	*949,873*	*298,672*	*1,248,545*
Central America, East Coast	*506*	*5*	*511*	*1,611,118*	*14,390*	*1,625,508*	*220*	*291*	*511*	*686,420*	*979,898*	*1,666,318*
10. Miscellaneous Atlantic	260	101	361	236,154	148,849	385,003	234	128	362	191,376	155,206	346,582
11. Miscellaneous Pacific	2	0	2	1,651	0	1,651	3	0	3	1,138	0	1,138
Grand total	3,617	1,399	5,016	10,005,344	3,969,408	13,974,752	4,315	686	5,001	12,882,875	1,544,254	14,427,129

Clearances under the heading of coastwise in bond embrace only non-bonded vessels and domestic coastwise vessels carrying goods to be transferred at some other American port to outgoing vessels in the foreign trade, for the reason that if the ship is to make one or more other domestic ports it is listed under one of the other categories, which are virtually subdivisions of the group "coastwise in bond."

Clearing Via Another American Port — Up to 1916 vessels carrying bonded goods and expecting to touch at another American port were listed as "clearing via another American port," whether they were bringing goods to the country or taking them away. In 1916 this category was further subdivided, and the original designation is now confined to outgoing vessels that have taken part loads at New York and are proceeding to other American ports to complete loading.

Vessels Permitted to Proceed with Residue of Cargo — Since 1916 vessels bringing goods to the country, discharging some of them at New York and proceeding to other ports to complete the discharging have been separated from the previous class in the registry of clearances, and are listed as "permitted to proceed with residue of cargo." This category therefore applies exclusively to imports.

Clearing for Non-Contiguous Territory — Vessels clearing for Hawaii, the Philippines or other territory belonging to the United States but not in the United States are listed as clearing for non-contiguous territory.

No such subdivision of the coastwise-in-bond movement or its subgroups was possible as in the case of the foreign-direct movement. No information is available as to origins or destinations, none as to which vessels were with cargo and which in ballast, and only the clearances are available by months. No separation whatever between the different kinds of movement covered by the different categories can be made.

The figures for the yearly total of these four classes of the bonded movement other than foreign direct are presented in Tables 4-7 for the years for which the records were drawn off from the customs figures. They show that the total number of vessels employed in the coastwise-in-bond movement was considerably more than half the number recorded in the foreign-direct movement, although the net registered tonnages were less than half because of the smaller average size of the vessel — none of the large liners being included in the coastwise-in-bond group. Both the number of vessels and the tonnages in the other three groups are much smaller.

Total Movement of Ships and Cargo

Table 8 estimates the total ship movement out of New York during the year 1914 in the foreign and coastwise trade. The figures exclude Hudson River and Sound traffic, even though it was necessary to make an arbitrary deduction to eliminate the small percentage of Sound steamers entered in the customs records.

Table 9 sums up the Commission's efforts to translate this movement of ships into probable cargo handled, and to add as much of the Sound and River cargo tonnage as could safely be assumed to have been carried. The net result is substantially 23,000,000 short tons of cargo.

TABLE 4 — YEARLY TOTAL FOR VESSELS LISTED AS "COASTWISE IN BOND"

	Entered		Cleared	
YEAR	Number of vessels	Net tonnage	Number of vessels	Net tonnage
1907	....	....	....	....
1908	....	....	....	....
1909	2,779	5,509,378	....	....
1910	3,477	6,795,283	....	....
1911	3,317	6,340,511	....	....
1912	3,118	5,925,370	3,182	6,595,800
1913	2,544	5,257,899	2,807	5,849,034
1914	2,459	5,437,533	2,820	6,130,194
1915	2,842	6,244,865	2,952	6,784,979
1916	2,866	5,924,854	2,858	6,432,173
1917	2,969	5,954,839	3,127	6,242,841
1918	3,338	5,469,775	3,651	6,080,310
1919	2,196	5,135,045	2,482	5,959,8[illegible]5

TABLE 5 — YEARLY TOTALS FOR VESSELS CLEARING VIA ANOTHER PORT

YEAR	Number of vessels	Net tonnage
1912	*365	*1,135,911
1913	*391	*1,176,501
1914	*377	*1,102,159
1915	*303	*826,889
1916	244	577,971
1917	264	604,599
1918	179	315,648
1919	219	517,828

* Before December, 1915, these figures included vessels permitted to proceed with residue of cargo.

TABLE 6 — YEARLY TOTALS FOR VESSELS PERMITTED TO PROCEED WITH RESIDUE OF CARGO

YEAR	Number of vessels	Net tonnage
1915*	5	13,239
1916	82	207,643
1917	57	140,194
1918	46	115,337
1919	31	109,158

* December only.

TABLE 7 — YEARLY TOTALS FOR VESSELS CLEARING FOR NON-CONTIGUOUS TERRITORY

YEAR	Number of vessels	Net tonnage
1912	154	339,408
1913	163	381,568
1914	152	363,037
1915	131	331,013
1916	140	358,392
1917	137	346,355
1918	109	247,378
1919	108	280,202

As previously stated, it was not considered feasible to make a similar estimate for goods entering the Port by water. Published reports of the values of exports and imports throughout the country would indicate that under normal conditions exports exceed imports, but not to an overwhelming degree, and the relative proportions of ships entering and clearing in ballast tend to support that view. If, therefore, we take into ac-

TABLE 8 — TOTAL CLEARANCES DURING 1914, EXCLUSIVE OF HUDSON RIVER AND SOUND VESSELS

CHARACTER OF CLEARANCE	Number of vessels	Net tonnage
Foreign trade	4,571	15,016,673
Coastwise trade*	3,796	7,680,259
Total	8,367	22,696,932

* Partly estimated.

TABLE 9 — ESTIMATED WEIGHT OF CARGO CLEARING PORT OF NEW YORK BY WATER DURING 1914

	Net tonnage clearing		Estimated cargo	
TRADE	In ballast	With cargo	Long tons	Short tons
Foreign direct	997,430	12,554,047	....	....
All other foreign	107,800	1,357,396	....	....
Total foreign	1,105,230	13,911,443	14,146,975	15,844,612
Coastwise in bond	1,134,758	4,625,436	4,955,842	5,550,523
Coastwise not recorded	378,253	1,541,812	1,651,941	1,850,174
Long Island Sound	....	....	....	1,300,000
Hudson River	....	....	....	357,853
Grand total				22,696,932

count the considerable amount of local Hudson River movement not in any way recognized in Table 9, we can probably safely assume that the total tonnage handled into and out of the Port of New York during the year just prior to the World War was around 45,000,000 tons, as compared with 76,000,000 tons handled by the railroads.

It is improbable that another estimator working from the same basic figures would reach precisely the same results as are recorded in Table 9. The Commission has made use, however, of the opinions of shipping experts as to the percentages it has used, and has verified them as far as possible by its studies of the existing records, and it believes it has arrived with reasonable accuracy at a figure which its representatives were assured at the outset could not be determined.

V — ANALYSIS OF INDIVIDUAL PERFORMANCES

The results of the steamship clockings, the study of existing steamship-company records and the tabulations from the maritime news service can best be considered under the one main heading of individual performances, inasmuch as all of the studies reflect sampling processes from which it is safe to make only general deductions. With respect to all of the matter in this section the Commission would emphasize two points — first, that the results set forth represent research in a vast unexplored field and give a considerable amount of useful information as to pier and ship performances not heretofore available; and second, that they point the way to the possibility of much more extended study along the same lines through a department under the direction of a permanent Port Authority, or possibly under the Federal Government in order to cover all ports.

All three of the individual-performance studies — the clocking analyses, the study of company records and the tabulation of maritime news — give information relative to ship performance in various phases, such as time for discharging and loading and total time in port, speed and cost per cargo unit of the different steps of discharging or loading through the individual hatches or side ports, character and extent of delay to the ship as a whole. Light on pier performance is shed chiefly by the study of steamship-company data, from which it was possible to follow through the operation of a succession of ships at four piers.

Ship Performance

Ship performance may be viewed from a number of different angles — the amount of cargo the ship brings and takes away, both in absolute quantity and in relation to her recorded capacity; the time she is in port and the use made of that time; the manner in which her incoming cargo is removed from the pier or otherwise disposed of, that in which her outgoing cargo is brought to her and that in which both are transferred from or to her hold; the time her individual hatches are worked, the methods and amount of labor employed, the commodities transferred, the rates of transfer and the costs in various units; the fueling methods employed. The Commission's studies give information on all of these phases.

CARGO CARRIED AND RELATION TO AVAILABLE SPACE

Table 10 presents characteristics of the twenty-six ships studied from the existing records — the net and gross registered tonnages of the ships themselves, and the amount of cargo, in several units, carried on the outward voyages under scrutiny. It also presents by way of comparison the net and gross tonnages of six of the ships clocked by the Commission's forces, and the amounts by weight of cargo. The figures are not available to complete the table.

Of the twenty-six vessels, it will be noted that the cargoes, including in some cases considerable amounts carried on deck, were in most instances greater than the

TABLE 10 — RELATION OF NET AND GROSS VESSEL TONNAGE TO CARGO CARRIED AND SPACE IT OCCUPIED ON OUTWARD VOYAGES

VESSEL		Net vessel tonnage, ship tons	Gross vessel tonnage, ship tons	Cargo measurement, cubic feet			Cargo weight, Long tons	Cargo, payable tons
				Under deck	On deck	Total		
Africa	*1*	3,543	5,592	365,407	2,958	368,365	6,911	9,663
	2	3,113	4,933	325,452	308	325,760	6,050	8,420
	3	3,153	5,035	317,655	19	317,647	5,716	8,493
	4	3,523	5,472	358,340	90	358,430	6,542	9,275
Brazil	*1*	2,310	3,739	252,173	12,882	265,055	4,714	7,027
	2	2,347	3,763	257,622	2,912	260,534	4,625	6,870
	3	3,133	4,956	239,743	222	239,656	3,843	6,683
	4	2,312	3,693	242,383	374	242,757	6,224	4,560
	5	2,701	4,238	147,784	214	147,998	2,547	3,722
	6	2,312	3,693	284,165	3,532	287,679	7,347	5,318
	7	2,713	4,247	220,974	73	221,047	3,571	5,565
	8	2,701	4,238	151,430	67	151,497	3,206	4,221
China	*1*	3,600	5,723	365,762	230	365,992	7,668	11,183
	2	3,615	5,706	326,905	105	327,010	7,890	10,396
	3	3,228	5,124	285,880	36,624	319,504	5,241	8,629
	4	3,507	5,559	374,985	7,790	382,775	6,926	10,812
	5	3,233	5,143	303,824	3,962	307,786	6,154	8,760
	6	3,600	5,723	341,294	612	341,906	7,247	10,181
India	*1*	3,554	5,553	375,565	10,942	386,507	7,567	10,894
	2	3,187	5,095	....	......	336,182	6,893	9,713
	3	3,537	5,515	417,605	386	417,991	7,499	10,499
	4	2,893	4,678	....	......	327,817	6,014	8,226
	5	3,681	5,883	412,112	4,538	416,659	8,025	11,103
	6	3,542	5,621	406,872	20,741	427,613	7,140	10,827
Java	*1*	2,743	4,336	306,950	24	306,974	5,688	7,674
	2	2,640	4,229	....	......	305,724	5,527	7,664
V		1,079	1,713	....	......	52,215	996	......
M		2,948	4,702	....	......	195,601	1,752	......
G		4,055	5,216	....	......	....	1,900	......
L		15,338	24,541	....	......	....	7,933	......
D		1,786	2,625	....	......	....	416	......
B		1,147	2,157	....	......	....	133	......

net tonnages would indicate. For example, the 3,543 vessel tons cargo capacity of the *Africa 1* are equivalent to 354,300 cu. ft. of cargo, since a ship ton is 100 cu. ft. It is to be noted that she actually carried 368,365, cu. ft. of cargo, probably due to the fact that cargo was stowed in various odd places not taken in to account in the registry of capacity. The load of 6,911 weight tons was presumably considerably on the safe side of what the ship was able to carry on the basis of weight, since deadweight carrying capacity, which includes fuel, stores and quarters for crew, is usually about 50 per cent in excess of gross tonnage — in this instance possibly 8,300 tons.

The cargo of the *Africa 1,* occupying 368,365 cu. ft., weighed 6,911 tons. At 40 cu. ft. per ton, the usual dividing line between the weight and the measurement basis for computing payable tons, it would have weighed 9,209 tons, as compared with the 9,663 payable tons shown in the table. This would indicate that the cargo was largely light and bulky and charged for by measurement.

The relationship between net and gross tonnage, cargo measurement, cargo weight and payable tonnage vary with the different ships, but not radically, so far as the group of twenty-six vessels is concerned. The incomplete data on the vessels clocked by the Commission's forces show a much smaller ratio of cargo to capacity. This is explained partly in the cases of the *V, M* and *L* by the fact that they carry passengers as well as freight and so have less space available for freight, while the *G,* a freighter operating on schedule, was obliged on the occasion of her clocking to sail with a part load because of a strike of longshoremen. She brought 6,400 tons of cargo to port, as compared with her net vessel tonnage of 4,055 tons.

A conception of the average sizes of ships serving the various world zones may be obtained from Table 11, which is based on 183 ships covered by the available records. The number of ships observed is too small a percentage of the total number of ships operating into and out of the Port to make the figures conclusive. It may be fairly accepted, however, that the ships in the United Kingdom and Europe proper trade average much larger than those in any other; that those in the Eastern Ocean, Mediterranean and African trade are next in size, that those of the South American and domestic coastwise are next and that those serving the West Indies and Central America are among the smallest.

TABLE 11 — AVERAGE VESSEL TONNAGES OF TYPICAL VESSELS SERVING DIFFERENT WORLD ZONES, AND RELATION OF NET TO GROSS TONNAGE

ZONE	Number of vessels in average	Average gross tonnage	Average net tonnage	Net in percentag of grosse
1. United Kingdom and Europe proper	21	10,806	6,172	0.61
2. Mediterranean	24	5,956	3,704	0.62
3. Africa — West, south and east coasts	9	5,265	3,427	0.66
4. India	12	6,028	3,852	0.64
5. Far East — East coast of Asia	18	6,034	4,055	0.64
6. East Indies and Australasia	18	6,378	4,107	0.65
7. South America — North and east coasts	20	4,381	2,888	0.66
8. South America — West coast	....	....	....	....
9. West Indies and Central America — East coast	27	3,290	2,060	0.62
10. Miscellaneous Atlantic	19	5,093	3,128	0.63
11. Miscellaneous Pacific	....	....	....	....
12. United States coastwise	15	4,301	3,014	0.69
Total	183	....	....	....
Average net in percentage of gross	....	....	....	0.63

Table 11 also shows more fully than Table 10 the relation of net tonnage to gross. The percentages of net to gross are strikingly close with respect to all of the zones except the twelfth. The United States coastwise vessels appear to have a slight advantage in this respect.

LAY DAYS IN PORT

While a ship is in port she is earning nothing, and much of the expense of operating her on the sea continues, in addition to berthing charges she escapes at sea. The chief purpose of a study of her operations and costs should be to reduce to a minimum the period the ship stays in port — the number of "lay days."

Ships remain at the Port of New York anywhere from twelve hours to forty days or more, depending on the service and many other conditions. The Sound passenger vessels remain in port from one to five days; transatlantic liners on the average five or six days. All of these vessels operate on schedule, which virtually compels their operators to pay less attention to cost and more to despatch than in the case of ships not on schedule. The longest lay periods are in general those of tramp freighters, particularly those plying to and from the most distant points; and it is probable that such ships offer the greatest opportunity for saving time.

The Commission's best information on lay days in port is derived from the maritime news-service records of arrivals and sailings. The attempt was made to draw off the length of time in port of at least sixteen vessels in each of the twelve world zones covered by Table 11. Steamers were used exclusively and those only whose net tonnages, as determined from Lloyd's Register of Shipping, were such as to suggest that they were typical cargo carriers. The records for August, 1919, sufficed for Zones 1, 2, 7, 9 and 12, in which there was the greatest movement. It was necessary to go over the records of some three years to get an adequate number of typical ships in some of the zones, and it was found impossible to obtain conclusive data relative to Zones 8 and 10. Some of the others cover less than the sixteen ships desired.

The results of this study are shown in Table 12, which covers the same 183 vessels as Table 11. The average number of lay days for the entire 183 vessels

TABLE 12 — AVERAGE NUMBER OF DAYS VESSELS SERVING DIFFERENT WORLD ZONES REMAINED IN PORT

ZONE	Number of vessels in average	Average number of days in port
1. United Kingdom and Europe proper	21	9.5
2. Mediterranean	24	13.5
3. Africa — West, south and east coasts	9	28.2
4. India	12	25.8
5. Far East — East coast of Asia	18	23.8
6. East Indies and Australasia	18	29.3
7. South America — North and east coasts	20	18.5
8. South America — West coast	....	....
9. West Indies and Central America — East coast	27	10.1
10. Miscellaneous Atlantic	19	16.5
11. Miscellaneous Pacific	....	....
12. United States coastwise	15	4.6
Total	183	....
Average	....	18.0

was practically eighteen, in terms of an equal number of vessels serving each of the ten zones covered by the table. Excluding the domestic coastwise traffic increases the average to 19.5 days.

Some idea of the effect of an average lay period of 9.5 days for the ships of Zone 1 was obtained by tracing the movement of seven of these ships from one to three years, thereby arriving at an approximation of the average time per round trip. One of the vessels, for example, with a net tonnage of about 10,000, made seven trips to England in 1917, using an average of thirty-seven days per round trip, 5.3 days of which were spent in the Port of New York.

These figures for round trips cannot be regarded as conclusive because of the interference with normal operations caused by the war and the submarine warfare. Such a record kept for a large number of ships during normal times would be instructive.

Among the ships clocked by the Commission, the *V,* a small vessel in the Venezuelan trade, lay five days in port; the *M,* a larger vessel in the Mexican trade, lay thirteen days, of which one was spent in dry dock; the *G,* a Gulf freighter, lay five days in port; the *L,* a large transatlantic liner which arrived in ballast, eleven days; the *D,* a New York-Boston freighter, about two days; the *B,* a New York-Boston passenger-and-freight vessel, about twelve hours. The clockings did not cover any vessels in the Far Eastern or "Eastern Ocean" trade, whose lay days average longest.

Liner Serving in Gulf and Coastwise Trade — Has Both Side Ports and Hatches

Of the nine vessels studied in detail from the existing records, the *China 1* remained thirty-five days in port, the *India 1* twenty-five days and the remaining seven shorter periods down to a minimum of fifteen days.

How the Lay Days Are Spent

In Table 12 we have arrived at an average lay period in port for 183 vessels of eighteen days. The study has been carried much farther with respect to a few of the ships to determine how the time is spent. The clockings show precisely the operations of the ships covered by them, in addition to which an extended study has been made of the longer lay periods of the nine ships selected for special investigation. Roughly speaking, a ship usually takes about three times as long to load as to discharge, because of the care required to load the goods in proper sequence and stow them properly. For one reason or another discharging and loading operations are not always carried on continuously at full speed, and the records give valuable data as to some of these reasons. They also give data as to such items as time spent in dry dock.

All of this information is set forth in graphical and condensed form in Fig. 9, Part IV, the earnest study of which the Commission recommends to all interested in the subject. In it are nine groups of bars representing the nine ships under study, characteristics of which are set forth in Table 10. The individual bars represent the different hatches of the vessels, together with the "peak" (cargo space in the extreme bow) and the "lazarette" (cargo space in the extreme stern).

The main vertical subdivisions set off the days in port, the maximum number of these being thirty-five. The lesser vertical subdivisions set off the normal working periods of each day. The different kinds of crosshatching or shading show the work actually done at each hatch, differentiating between discharging and loading and between transfer to and from the pier and to and from lighters.

Perusal of this chart will show the degree to which each hatch was worked, while the various explanatory notes will shed valuable light on the reasons why the hatches were not worked continuously.

Similar charts might be prepared to cover the ships clocked by the Commission's forces. They would be less instructive because the ships were in port for shorter periods. In their general aspects they would be much the same.

The *V* spent virtually 1½ days discharging her cargo, a half day being lost through the necessity of fumigating the ship, while loading consumed about two days, the ship being in port four days. The *M* was in port thirteen days, of which three were consumed in discharging, 4½ in loading, one day was spent in dry dock and the remaining 2½ days, which included a Sunday, the ship was idle.

The *G* was in port seven working days (six nights), of which period three days were spent in discharging and three in loading, no work being done on the seventh day, a Sunday. A strike of longshoremen delayed the loading or, rather, reduced the amount of cargo the ship could take before sailing.

The *L*, arriving in ballast, was in port eleven days, virtually all of the time except Sunday during working hours being utilized.

Interior of Manhattan Pier — Receiving and Loading Outbound Freight for Gulf and Coastwise Trade

TRANSFER OPERATIONS

Transfer operations and costs are subject to many conditions. Cargo may be transferred through either hatches or side ports. It may be between ship and pier, between ship and truck or freight car on the pier, between ship and lighter across the pier, between ship and lighter direct on the offshore side, or between ship and car float. The sizes and weights of packages or other shipping units vary within wide limits, as do the types of machinery for effecting the transfer, the character of the ship itself and the sizes and convenience of the ports or hatches. The methods of handling the work vary, and loading operations are quite different from unloading operations.

The conditions are discussed at considerable length in Chapter 27 on freight handling machinery. In view of the impossibility in the time available of making analyses, by clocking or otherwise, of the operations of enough ships to cover all conditions, the Commission will not attempt to state what any operations may be expected to cost, but will confine itself to setting forth what certain operations did cost and the conditions of those operations. In more or less detail the Commission will describe the clockings and analyses of the steamships *V, M, G* and *L*, and the analysis of the steamship company's records for the *China 1*. The data presented pertain to a passenger-and-freight vessel serving Zone 7, a vessel similar but larger serving Zone 9, a freighter serving Zone 12, a passenger liner serving Zone 1 and a freighter serving Zone 5. All but the latter are on the basis of operations and costs in 1919. There is also information included relative to two vessels not belonging in any of the zones but in the Long Island Sound service, information relative to coaling performances and information as to the lighterage operations in conjunction with the loading and discharging of the ships clocked.

STEAMSHIPS *V* AND *M*

Time was not available for a full analysis of all of the clocking figures. The steamships *V* and *M* were selected as the most illuminating in their general operations, the other clockings being drawn upon only to develop certain data best shown by the ships they covered.

The *V*, arriving on a Sunday in January, 1919, at a typical Brooklyn pier, with 1,114 tons of cargo, discharged her load, took on a supply of coal and a cargo of 996 tons for four ports of call (see next page), and departed the following Thursday. Discharging consumed virtually one and one-half days, a half day being lost through the necessity of fumigating the ship. Loading began late the second day, before discharging was completed, and occupied most of the remaining time in port. Coaling was begun the second day in port and carried on simultaneously with the discharging, from barges on the offshore side, and was completed shortly after loading was started. No cargo was discharged into lighters, but two lighters took incoming cargo from the pier, while six lighters brought outgoing cargo, of which three transferred their freight to the ship direct and three via the piers.

The *M* arrived at a Brooklyn pier in February, 1919, with 2,537 tons of freight. She began discharging immediately upon arrival, working virtually three full days and completing the unloading by working until 3:20 a. m. the third night. The following day she was taken to a dry dock for repairs. At about the same hour the next day, a Friday, the repairs having been completed, she was taken to a Manhattan pier in the East River adjoining the one at which she was to receive her load. She lay there until Monday morning, when she was moved across the slip and coaling and loading were begun.

Loading 1,752 tons of inbound cargo occupied 4½ calendar days, in which the operations were carried on 3½ working days, 1½ nights and half a day on a holiday. The ship sailed as soon as loading was completed, 12 days after arrival.

The ship discharged direct to three lighters as well as to the pier, the lighters receiving copper and lead. Goods were loaded upon the ship direct from twelve lighters as well as from the pier.

DIFFERENCES IN GENERAL CONDITIONS

The general pier operations were quite different in the cases of the two ships. The *V* discharged and reloaded at the same pier. The incoming cargo was temporarily stored at one end of the pier, and most of the outgoing cargo was received before the ship arrived and stowed with reference to the order of loading upon the ship. The *M* discharged and loaded at separate piers, and the cargo loaded, except for the goods brought by lighter, was trucked upon the pier daily, so that there was little storing on the loading pier, and the pier was left practically empty each night.

There were numerous other differences in the conditions surrounding these two ships. The *V* was a three-hatch vessel with no side ports; the *M* had four hatches and four side ports. The *V* had a net tonnage of 1,079 tons, the *M* one of 2,948 tons. The inbound cargo of the M was far more varied than that of the *V*. The *M* discharged to both the pier and lighters, the *V* only to the pier. The labor in the case of the *V* was employed and paid by the contracting stevedore; the longshoremen working the *M* were employed and paid directly by the steamship company.

The Commission will not undertake to state the effect of these differing conditions on the cost or speed of transfer. They should be taken into account, however, in the perusal of the tables and charts that follow.

KINDS, AMOUNTS AND DESTINATIONS OF CARGO

Coffee constituted 74 per cent, or 827 tons, of the *V*'s inbound cargo of 1,114 tons, coming under thirty-one different marks. Sugar constituted 12 per cent or 137 tons, skins and hides 8 per cent or 82 tons, and miscellaneous freight 6 per cent or 68 tons.

Outbound the V carried 996 tons of miscellaneous freight, including structural steel, iron, pipe, lumber, automobiles, flour, barbed wire, paper and other commodities in packages of various sizes and weights. Of this cargo 83 tons were destined for Mayaguez, 301 tons for La Guayra, 300 tons for Curacao and 312 tons to Maracaibo, the four ports being in the order named.

The *M* brought 2,537 tons of skins, hides, coffee, lead, copper, chicle, honey, vanilla, drugs and miscellaneous freight. She took on an equally diversified cargo of 1,752 tons, of which the amounts for the different ports of call were, in order: Havana, 93 tons; Progreso, 155 tons; Vera Cruz, 1,124 tons; Tampico, 380 tons.

PIER-STORAGE AND SHIP-STOWAGE DIAGRAMS

Fig. 5 shows the distribution of the outgoing and incoming cargo of the *V* on the pier, and in diagrammatic form the two positions of the ship and her hatches. Fig. 6 is the stowage diagram for the ship on her outward voyage.

Most of the outgoing cargo reached the pier first, and was placed by ports of call at the outer end. As Maracaibo was to be the last port of call, the goods for that port were to be placed largely in the bottom of the hold, and the space on the ship side of the pier was given over mainly to Maracaibo goods. On the opposite side the space was broken up into the smaller consignments for the upper part of the hold.

For convenience of removal by consignees the inbound cargo was assorted, separate spaces being provided for each of the thirty-one grades of coffee.

Fig. 7 is the stowage diagram for the *M*. The large amount of cargo for the third port of call, Vera Cruz, had to be so placed that the ship would be trim after the Vera Cruz freight had been removed. The ship, it will be noted, had two blind hatches (hatches which do not come through to the upper deck), one just ahead of and one just aft of the engine room. Access to these hatches was had by trucking from the main hatches or from the side ports.

SPEED AND COSTS OF CARGO TRANSFER

Table 13 shows the speed of cargo transfer of the *V* and the *M*, both in discharging and in loading, in hatch-hours and man-hours actually worked. For reasons already set forth, it would be unsafe to accept

TABLE 13 — SPEED OF TRANSFERRING CARGO OF STEAMSHIPS *V* AND *M*

STEAMSHIP	Hatch-hours actually worked	Man-hours actually worked	Tonnage transferred		
			Total	Per Actual working hatch-hour	Per actual working man-hour
	Discharging				
V	42	1,638	1,114	26.33	0.68
M	149	4,268	2,537	*17.02	0.59
	Loading				
V	55	1,668	996	18.11	0.60
M	203	3,570	1,752	*8.52	0.49

* Two side ports, through which 18 per cent of cargo was discharged and 8 per cent loaded, considered as two hatches.

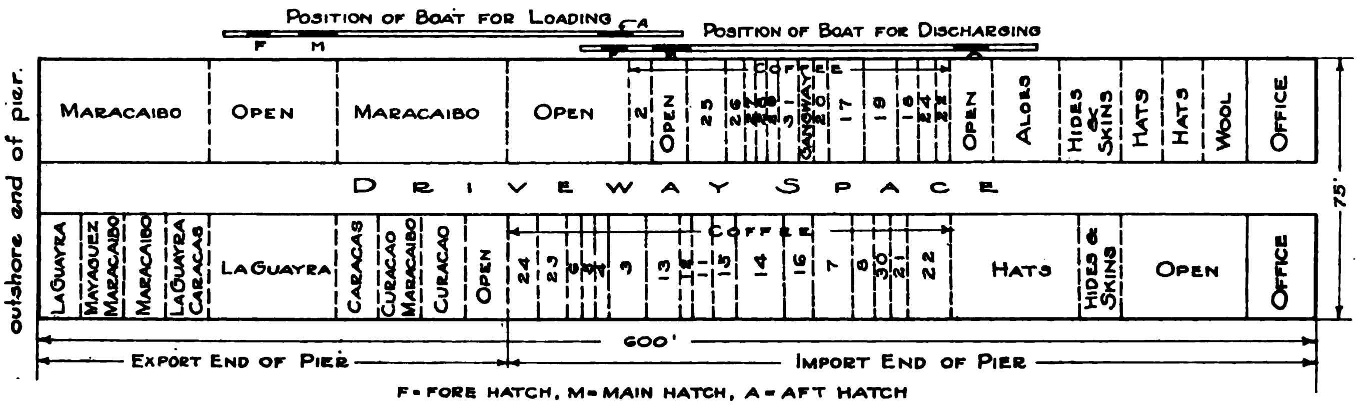


Fig. 5 — Layout for Discharging and Loading Steamship V — Ports of Call Mayaguez, La Guayra, Curacao and Maracaibo

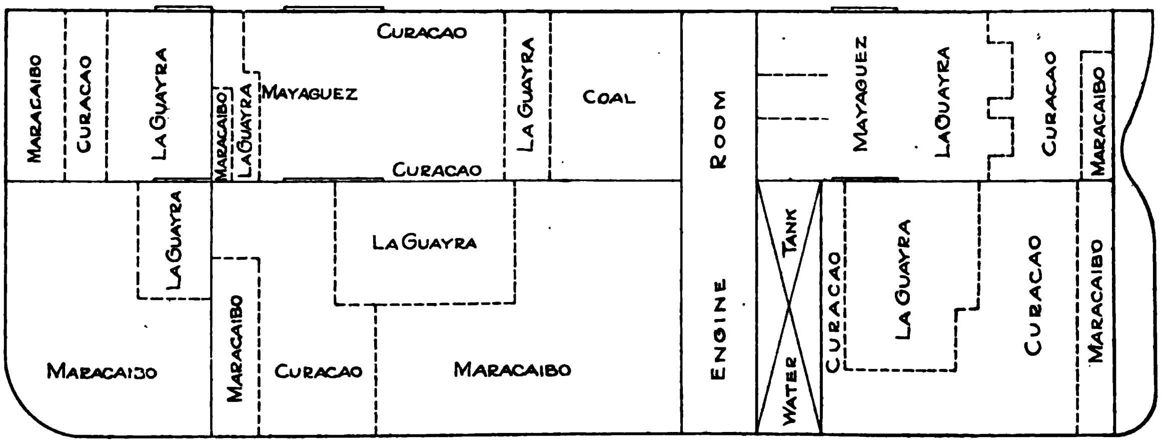


Fig. 6 — Stowage Diagram for Steamship *V* — Ports of Call Mayaguez, La Guayra, Curacao and Maracaibo in Order Named

any of these figures for precise calculations. They give, however, an idea of the range.

Since the *V* discharged 26.33 tons and loaded 18.11 tons per hatch-hour, and since there were three hatches, the average rates for the ship as a whole were about 79 tons per hour discharging and 54 tons per hour loading. There were several reasons for this difference of 25 tons, all more or less characteristic of the Port of New York. In the first place setting incoming goods on a pier for early removal is a much less painstaking operation than first selecting such goods as will give a maximum revenue load for the ship and then stowing them in the hold in such manner that the ship will be seaworthy, that the goods will not shift in rough weather and that there will be no damage to them, as through the contact of oil with flour. Another reason applies to a large percentage of the vessels coming to New York, namely, the greater variety of outgoing cargo. In the case of the *V*, a great part of the incoming cargo was coffee and sugar, which could be handled in uniform packages by routine processes, while the outgoing cargo included structural steel, pipe, lumber, automobiles, flour, barbed wire, paper and miscellaneous packages of various sizes and weights.

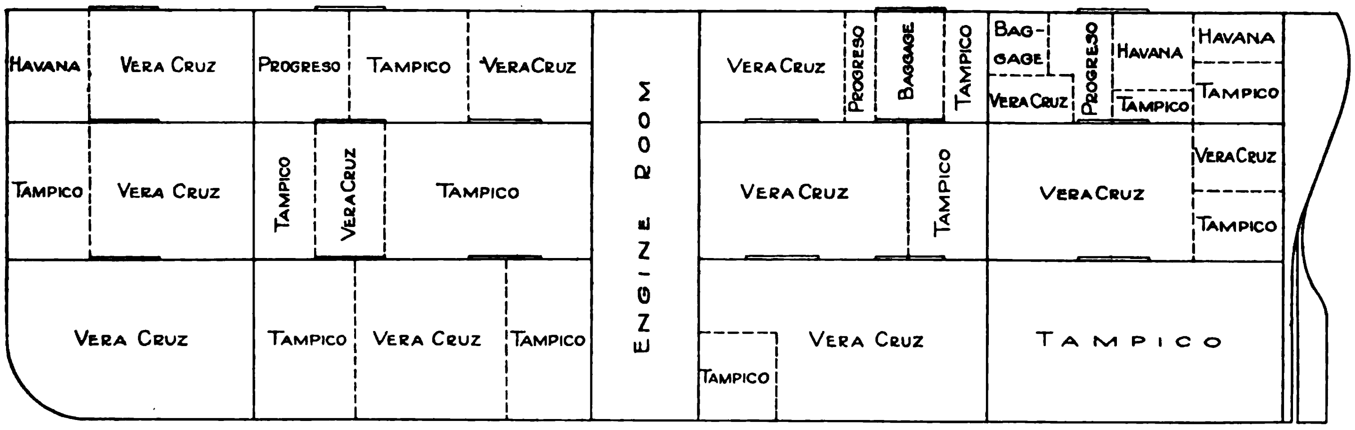


Fig. 7 — Stowage Diagram for Steamship *M* — Ports of Call Havana, Progreso, Vera Cruz and Tampico in Order Named

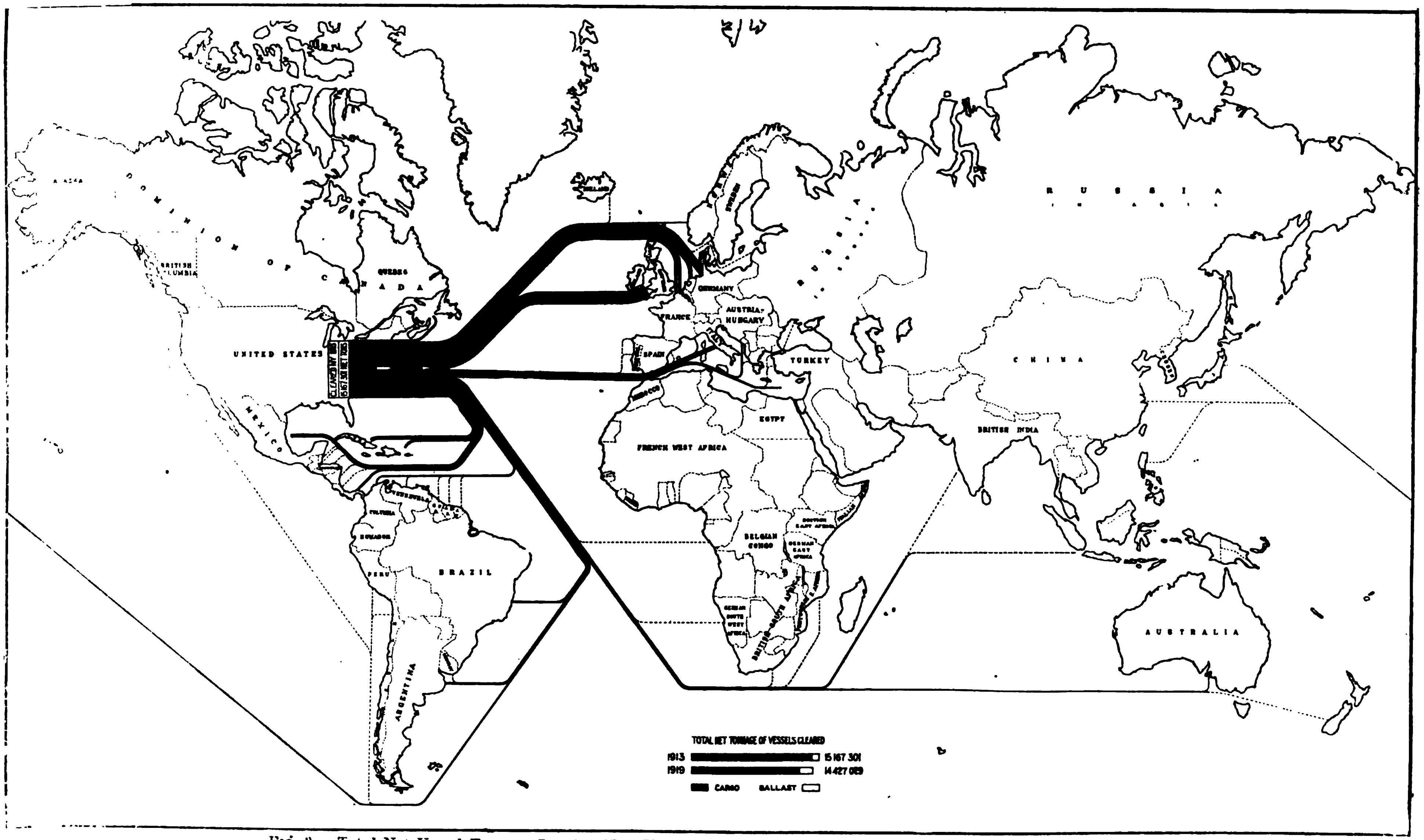


Fig. 3 — Total Net Vessel Tonnage Leaving New York in the Foreign Trade, Showing the Countries of Destination, in 1913

Dotted lines indicate that the net vessel tonnage was less than 150,000 tons

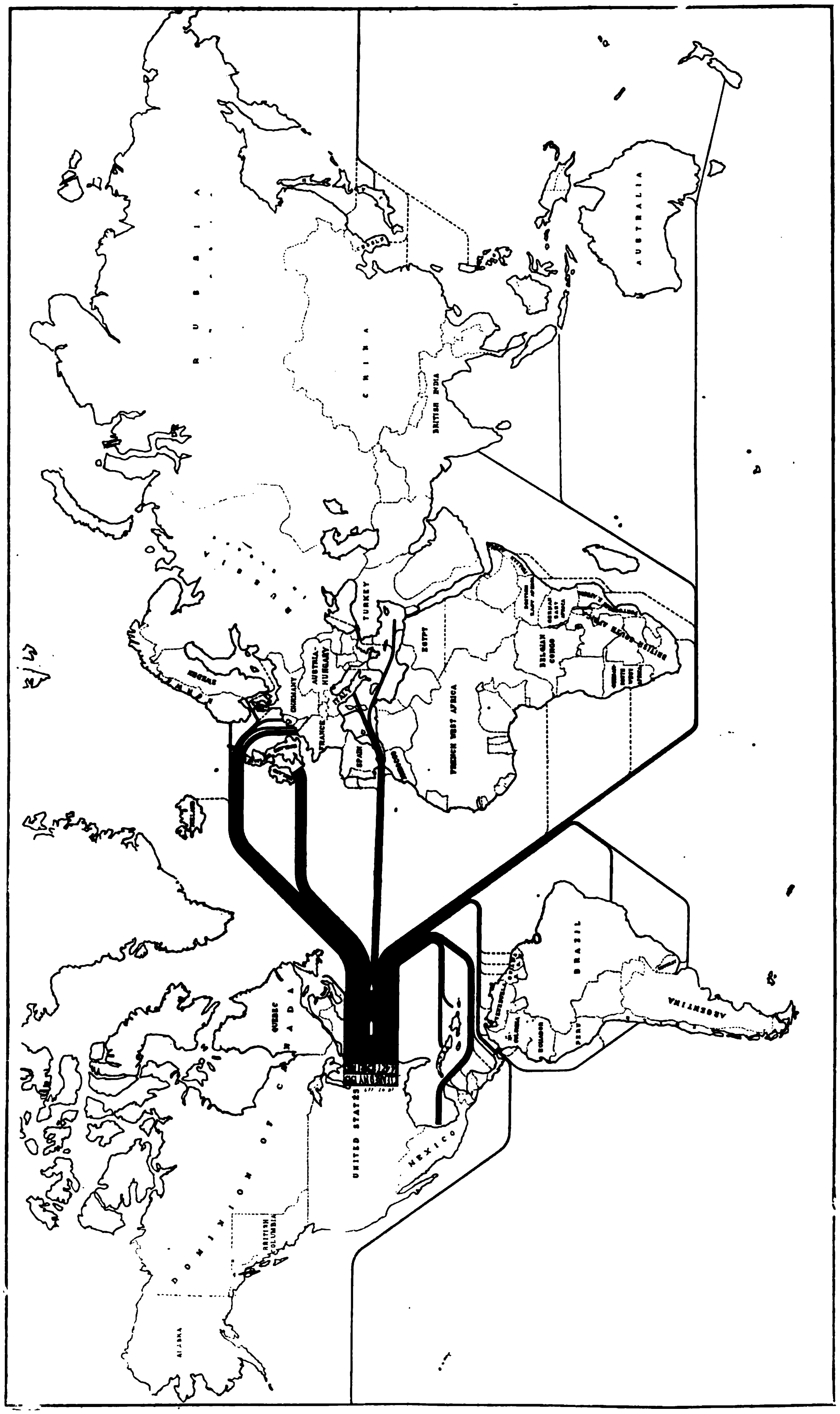


FIG. 4 — Total Net Vessel Tonnage Leaving New York in the Foreign Trade, Showing the Countries of Destination, in 1919

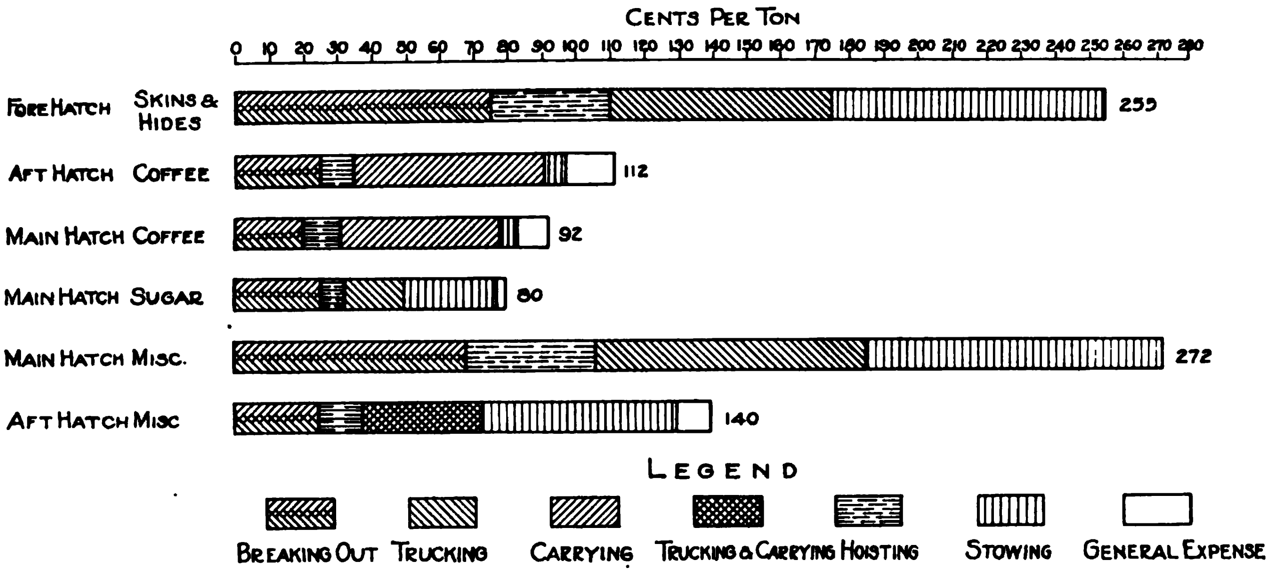


Fig. 13 — Costs by Commodities, Discharging to Pier — Steamship *V*

	Skins and hides, fore hatch	Coffee		Sugar	Miscellaneous	
		Aft hatch	Main hatch	Main hatch	Main hatch	After hatch
Tonnage	82	327	500	72	13	55
Slings per hour	17.6	41	58	137	....	....
Average sling load, pounds	975	1,430	1,430	1,100	....	....
Weight per bag, pounds	....	130	130	200	....	....

and the individual equations of the laborers and the foremen.

The commodities handled have much bearing on the transfer costs. As the tabular matter under Fig. 10 indicates, most of the incoming cargo in the main hatch of the *V* was coffee. This hatch shows the highest rate of discharge of any on either of the two ships, and the lowest unit cost of any except Fore Hatch 3 of the *M*, which discharged largely to lighters and so does not bear the entire burden of the cost of transfer. The manner of attaining this high rate and low cost is described in some detail on page 197, as are the operations connected with a number of other commodities handled by the *V*, *M* and other ships clocked.

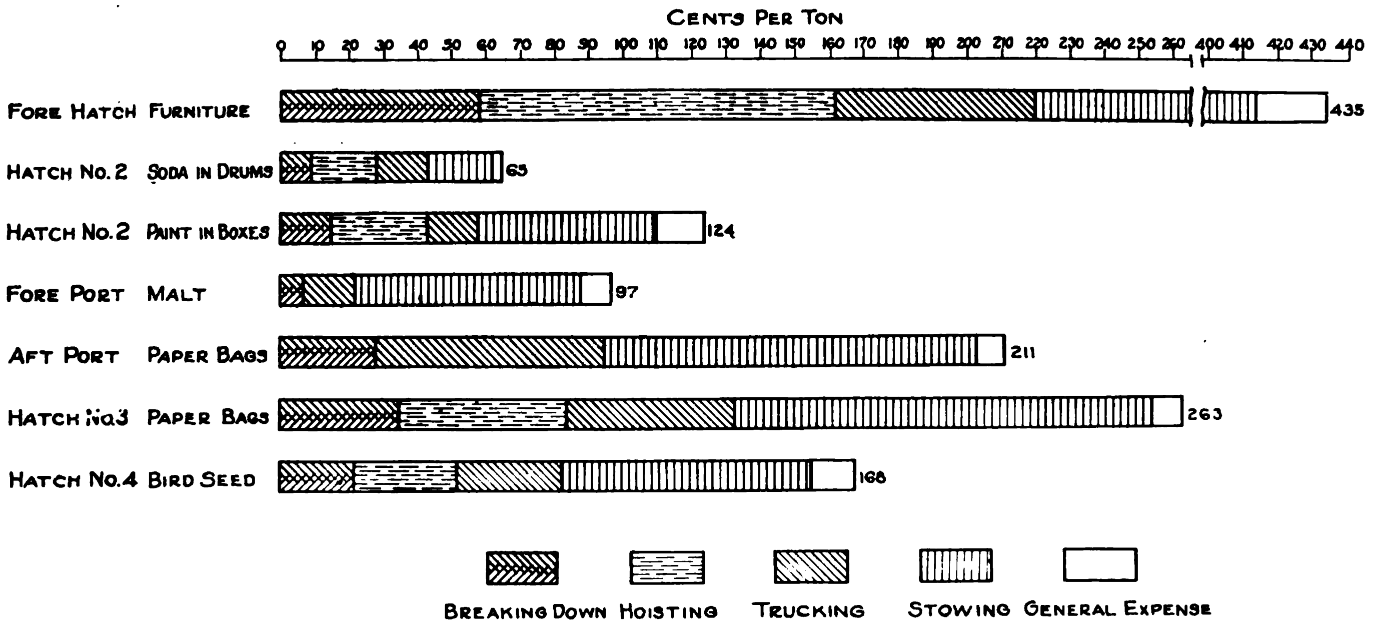


Fig. 14 — Costs by Commodities, Loading from Pier — Steamship *M*

	Furniture, fore hatch	Soda in drums, hatch 2	Paint in boxes, hatch 2	Malt, fore port	Paper bags		Bird seed, hatch 4
					Aft port	Hatch 3	
Tonnage	2.9	63.2	8	*8.7	5.7	7	9.8
Slings or trucks per hour	27	28	22.7	....	66	19	13
Average sling or truck load, pounds	106	1,500	1,058	....	195	821	1,368
Pieces per sling or truck	2	2	13.5	....	3	12.5	10.7
Percentage of overtime	....	....	....	....	....	†100	....

---

* Malt was shunted down gang plank at rate of 233 11-pound bags per hour.

† Cost per ton, based on all straight time, $1.75.

In the case of Fig. 11, covering the discharging of the *M*, the most striking contrast is in the discharging through hatches and through side ports. The advantage for the commodities handled is evidently with the hatches, every operation except hoisting being cheaper via them. A substantial reason for the higher costs through the ports is that both the fore and aft ports served only one deck of the ship direct, and extra handling from or to any other deck was necessary if service was rendered them through the ports.

The goods, it may be noted, were largely commodities well adapted to handling by ship's tackle. In loading the more varied commodities of the outward voyage the fore port held its own with the hatches. The tonnage that passed through the after port was too small to signify.

Mention was made of the character of the commodity as one of the most important factors in the transfer costs. Another, which itself depends on the character of the commodity, is the method of transfer, whether between ship and pier or between ship and lighter. Figs. 13–16 inclusive combine these factors

Lighters Moored at Pier's End — Not the Safest Mooring Place

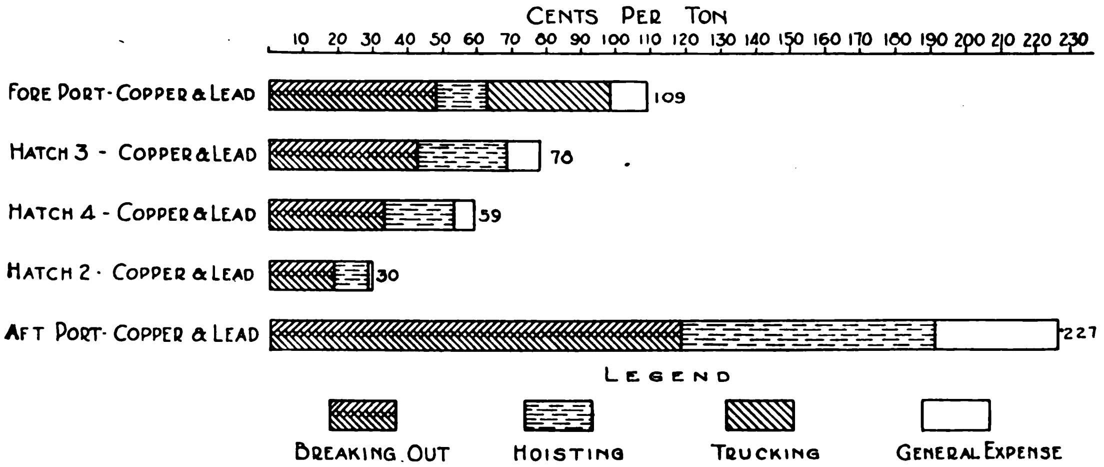


FIG. 15 — Costs of Discharging Copper and Lead to Lighters — Steamship *M*

	Fore hatch	Hatch 3	Hatch 4	Hatch 2	Aft port
Tonnage	75.5	265	212	22.3	24
Slings per hour	5.1	17.4	32.3	33.3	18.8
Average sling load, pounds	2,795	1,404	1,400	2,000	535
Weight per piece, pounds	215	120	140	100	128
Percentage of overtime	17	45	19	....	100

No other commodities discharged to lighters.

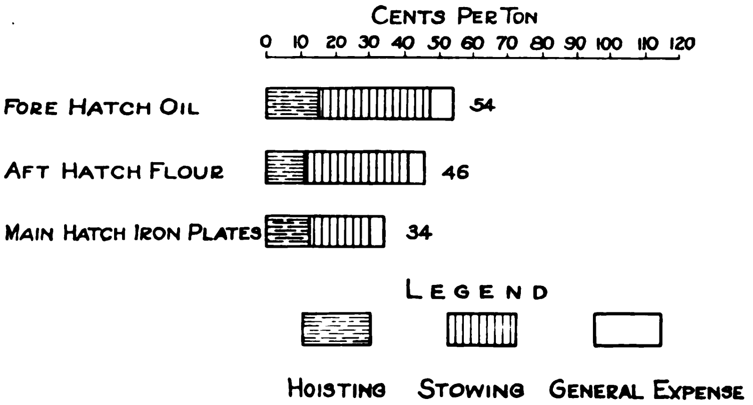


FIG. 16 — Costs by Commodities, Loading from Lighters — Steamship *V*

	Oil, fore hatch	Flour, aft hatch	Iron plates, main hatch
Tonnage	35	124	130
Slings per hour	75	46	10
Average sling load, pounds	520	1,150	6,453
Weight per piece, pounds	65	174	....
Percentage of overtime	....	38	28

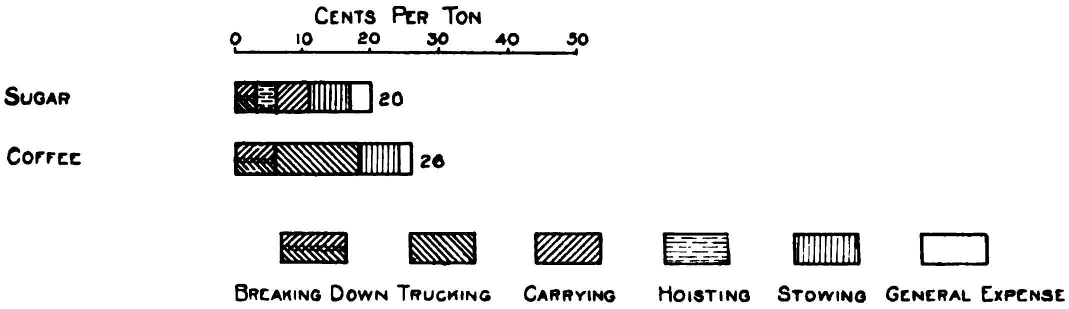


FIG. 17 — Commodity Costs, Loading Lighters from Pier

	Sugar	Coffee
Tonnage	135	100
Tonnage per hour	23.5	22

Sugar carried, one 200-pound bag per man; coffee trucked, four 132-pound bags per truck, 95 trucks per hour.

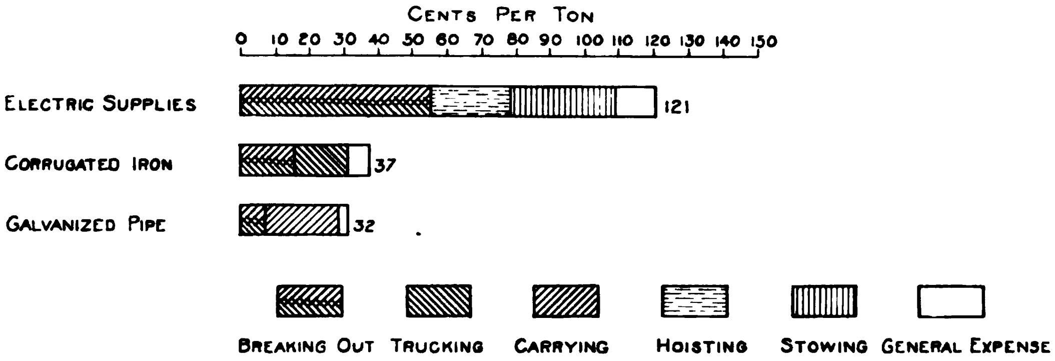


FIG. 18 — Commodity Costs, Discharging Lighters to Pier

	Electrical supplies	Corrugated iron	Galvanized iron pipe
Tonnage	9	67	16
Tonnage per hour	5.1	11.6	15.2
Truck loads per hour	....	38	....
Average load per truck, pounds	....	683	....
Average weight per piece or bundle, pounds	146	153	....

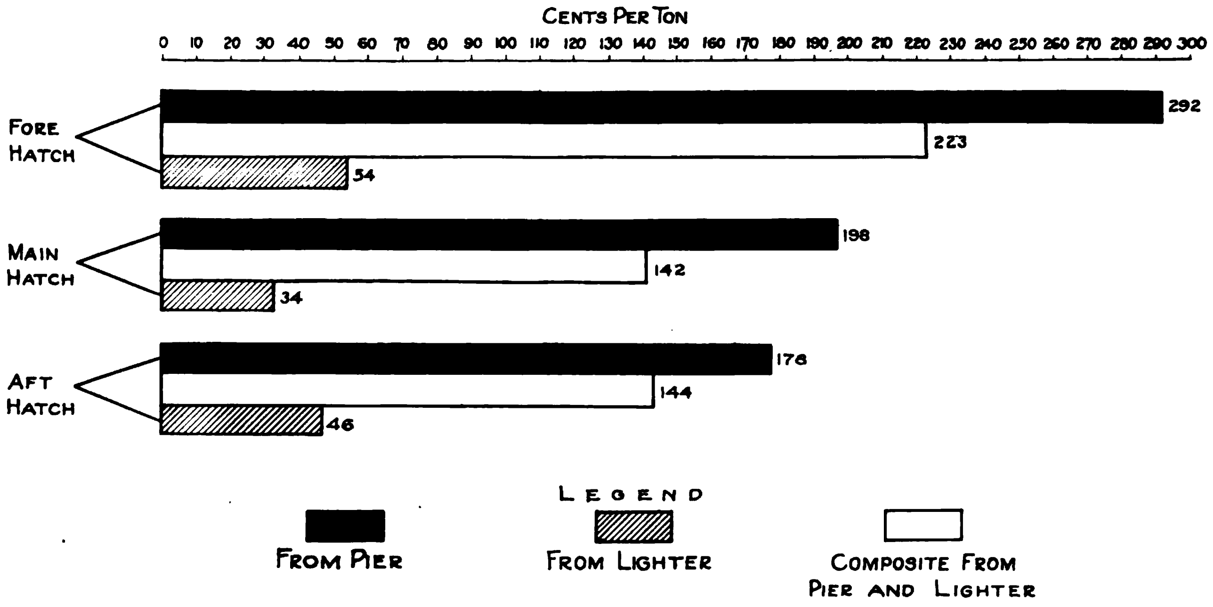


FIG. 19 — Relative Cost to Steamship Company of Loading from Pier and Lighter — Steamship T

to cover respectively discharging from ship to pier, loading from pier to ship, discharging from ship to lighter and loading from lighter — separation being made in each case as between hatches, principal commodities and major operations. Tabular matter under each set of diagrams sets forth pertinent information as to the total amount of the commodity, the load per sling, the number of slings per hour and other details. Two of the sets of diagrams pertain to the *V* and two to the *M,* merely because that ship was selected in each case which offered the more information along the particular lines desired.

Typical performances of the remaining two main methods of transfer — from pier to lighter for inbound cargo previously unloaded from the ship, and from lighter to pier for outbound cargo to be subsequently placed upon the ship — are illustrated in Figs. 17 and 18, which follow the form of Figs. 13–16.

These diagrams are obviously only a start toward a full picture of the speed and unit costs with which various commodities can be handled. They bring out several important facts, however. One is that there is a wide range between the costs of handling different commodities, goods in uniform packages, such as coffee, sugar, oil and the like, being much cheaper to handle than miscellaneous freight, or bulky freight such as furniture. It may be pointed out that the disadvantage of furniture and paper bags, Fig. 14, and of a number of the other commodities with long bars opposite them in the diagrams, is considerably less than appears. The bars are based on weight tons of 2,240 lb. Many of the commodities, however, are charged for on the basis of measurement. A weight ton of furniture, for example, might be well on toward two payable tons, and the transfer cost to the steamship company might be less than $3 instead of $4.35 per payable ton.

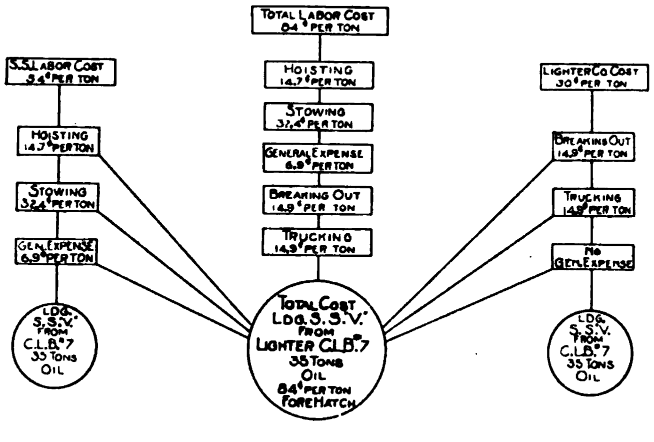

TOTAL LABOR COST 84¢ PER TON
S.S. LABOR COST 54¢ PER TON
HOISTING 14.7¢ PER TON
STOWING 32.4¢ PER TON
GEN. EXPENSE 6.9¢ PER TON
LDG. S.S. "V" FROM C.L.B. #7 35 TONS OIL
HOISTING 14.7¢ PER TON
STOWING 32.4¢ PER TON
GENERAL EXPENSE 6.9¢ PER TON
BREAKING OUT 14.9¢ PER TON
TRUCKING 14.9¢ PER TON
TOTAL COST LDG. S.S. "V" FROM LIGHTER C.L.B. #7 35 TONS OIL 84¢ PER TON FORE HATCH
LIGHTER CO COST 30¢ PER TON
BREAKING OUT 14.9¢ PER TON
TRUCKING 14.9¢ PER TON
NO GEN. EXPENSE
LDG. S.S. "V" FROM C.L.B. #7 35 TONS OIL

Fig. 20 — Total Cost per Ton, Loading Oil from Lighter to Ship

Steamship labor	Lighter company labor
cycle 2 hr.	cycle 2 hr.
17½ tons per hour.	17½ tons per hour.
75 slings per hour.	75 truck loads per hour.
520 pounds per sling	520 pounds per truck.
All straight time.	All straight time.

Another fact brought out by the diagrams is that direct lighterage transfer has a decided advantage over pier transfer in the matter of cost to the steamship company. This fact is illustrated strikingly by Fig. 19, which covers the loading of the *V*. The pier operations at each hatch cost several times as much per ton as the lighter operations. The *V* did not make as much use as the *M* of the advantage of the lighter operations, and the average cost at each hatch is more nearly the pier figure than the lighter figure. The diagrams suggest the need to go slowly in any program to do away with lighter-direct transfer over the ship's offshore side.

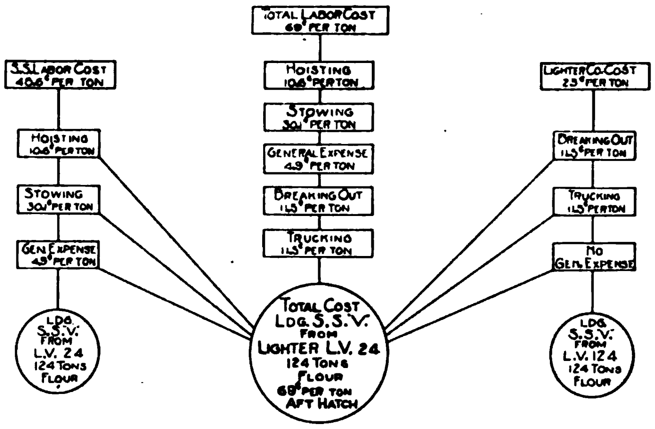

TOTAL LABOR COST 69¢ PER TON
S.S. LABOR COST 40.6¢ PER TON
HOISTING 10.6¢ PER TON
STOWING 30.1¢ PER TON
GEN. EXPENSE 4.9¢ PER TON
LDG. S.S. "V" FROM L.V. 24 124 TONS FLOUR
HOISTING 10.6¢ PER TON
STOWING 30.1¢ PER TON
GENERAL EXPENSE 4.9¢ PER TON
BREAKING OUT 11.5¢ PER TON
TRUCKING 11.5¢ PER TON
TOTAL COST LDG. S.S. "V" FROM LIGHTER L.V. 24 124 TONS FLOUR 69¢ PER TON AFT HATCH
LIGHTER CO. COST 23¢ PER TON
BREAKING OUT 11.5¢ PER TON
TRUCKING 11.5¢ PER TON
NO GEN. EXPENSE
LDG. S.S. "V" FROM L.V. 124 124 TONS FLOUR

Fig. 21 — Total Cost per Ton, Loading Flour from Lighter to Ship

Steamship labor	Lighter company labor
cycle 5.25 hr.	cycle 5.25 hr.
23.6 tons per hour.	23.6 tons per hour.
46 slings per hour.	46 truck loads per hour.
1,150 pounds average per sling.	1,150 pounds per truck.
38 per cent overtime.	45 per cent overtime.

Free lighterage has an important bearing on the relative costs of land and lighter operations. Railroad freight rates in most cases, as has been pointed out, include delivery by lighter to or from ship side — that is, to or from the ship's tackle — or to or from the deck of the pier. The rates of private lighterage companies making local deliveries are based on a similar service where the transfer is over the offshore side. Consequently the costs to the steamship company, which are those shown in Figs. 15–18, were not the full costs of the operations. This fact is illustrated in Figs. 20–22

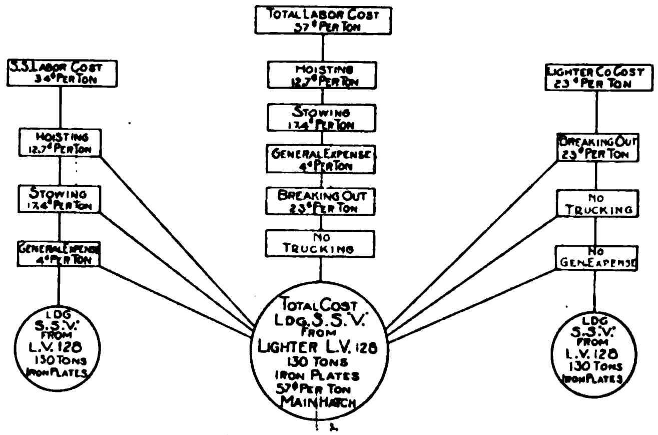

TOTAL LABOR COST 57¢ PER TON
S.S. LABOR COST 34¢ PER TON
HOISTING 12.7¢ PER TON
STOWING 17.4¢ PER TON
GENERAL EXPENSE 4¢ PER TON
LDG S.S. "V" FROM L.V. 128 130 TONS IRON PLATES
HOISTING 12.7¢ PER TON
STOWING 17.4¢ PER TON
GENERAL EXPENSE 4¢ PER TON
BREAKING OUT 23¢ PER TON
NO TRUCKING
TOTAL COST LDG. S.S. "V" FROM LIGHTER L.V. 128 130 TONS IRON PLATES 57¢ PER TON MAIN HATCH
LIGHTER CO COST 23¢ PER TON
BREAKING OUT 23¢ PER TON
NO TRUCKING
NO GEN. EXPENSE
LDG S.S. "V" FROM L.V. 128 130 TONS IRON PLATES

Fig. 22 — Cost per Ton, Loading Iron Plates from Lighter to Ship

Steamship labor	Lighter company labor
cycle 4½ hr.	cycle 4½ hr.
29 tons per hour.	29 tons per hour.
22 slings per hour for 1¼ hour.	32 per cent overtime.
5 slings per hour for 3¼ hour.	
6,665 pounds average per sling.	
28 per cent overtime.	

covering the operations of the three lighters from which cargo was transferred direct to the *V*, each bringing a different commodity. The diagrams are made up with three branches each, the left being reproductions in another form of the three bars in Fig. 16, the right showing the additional costs to the lighter companies, the center showing the total cost. All breaking out and all trucking come in the lighter companies' costs. The total costs, however, are still far below the prevailing costs over the pier. Figs. 17 and 18 further illustrate the relatively low cost to the steamship company of loading and unloading lighters.

HOOK PERFORMANCES BY COMMODITIES

A special study was made of speed of handling through hatches as many different commodities as possible. The study covered every commodity in which the clocking records showed complete information as to (1) number of hook cycles, (2) number of pieces per hook and (3) number of short tons (2,000 lb.) per hook by hours for three or more consecutive hours. It was based upon the performances of all seven of the ships with hatches — the steamships *V, M, G, L, E, H* and *F* — but does not in all cases include the best recorded performances because of the insufficiency in certain cases of the data.

Fig. 23 covers discharging operations for eight commodities. The left-hand section of each row of diagrams pertains to sugar, those adjacent to sugar pertain to coffee, and so on, the narrow sections at the right-hand end of each row all pertaining to ixtle. The upper row of diagrams shows the average number of hook cycles per hour, or in other words, the number of sling-loads taken from the hold; the middle row shows the load per hook, and the bottom row shows the resultant of the two — the average number of short tons per hook-hour.

Along the base are scales which indicate the periods covered by the observations. Most or all of the diagrams are composites of the performances of several ships and a larger number of hatches. The vertical subdivisions of the diagrams at irregular intervals set off periods of from two to eleven hours covering virtually continuous performances through a single hatch. The heavy horizontal line across each subdivision indicates the average performance for that period. The small solid circles indicate the best and the open circles the poorest hourly performance within the period, the short vertical shade lines serving merely to visualize the range of variation. And finally, the averages of these individual hatch performances are indicated by the shaded vertical bars at the right-hand side of each individual diagram.

The distinction should be recognized between hook-hour and hatch-hour performances. In a number of instances two hooks were operating into or out of a single hatch, and Chapter 27 on freight-handling machinery points out that with large hatches it is often feasible to work three hooks in one hatch. In the cases under observation, however, the hooks, where two were working in the same hatch, were usually working on opposite sides of the ship, or were handling different commodities. The one instance where two hooks were handling the same commodity appears in the diagrams.

The following salient features relative to the discharging of commodities should be noted:

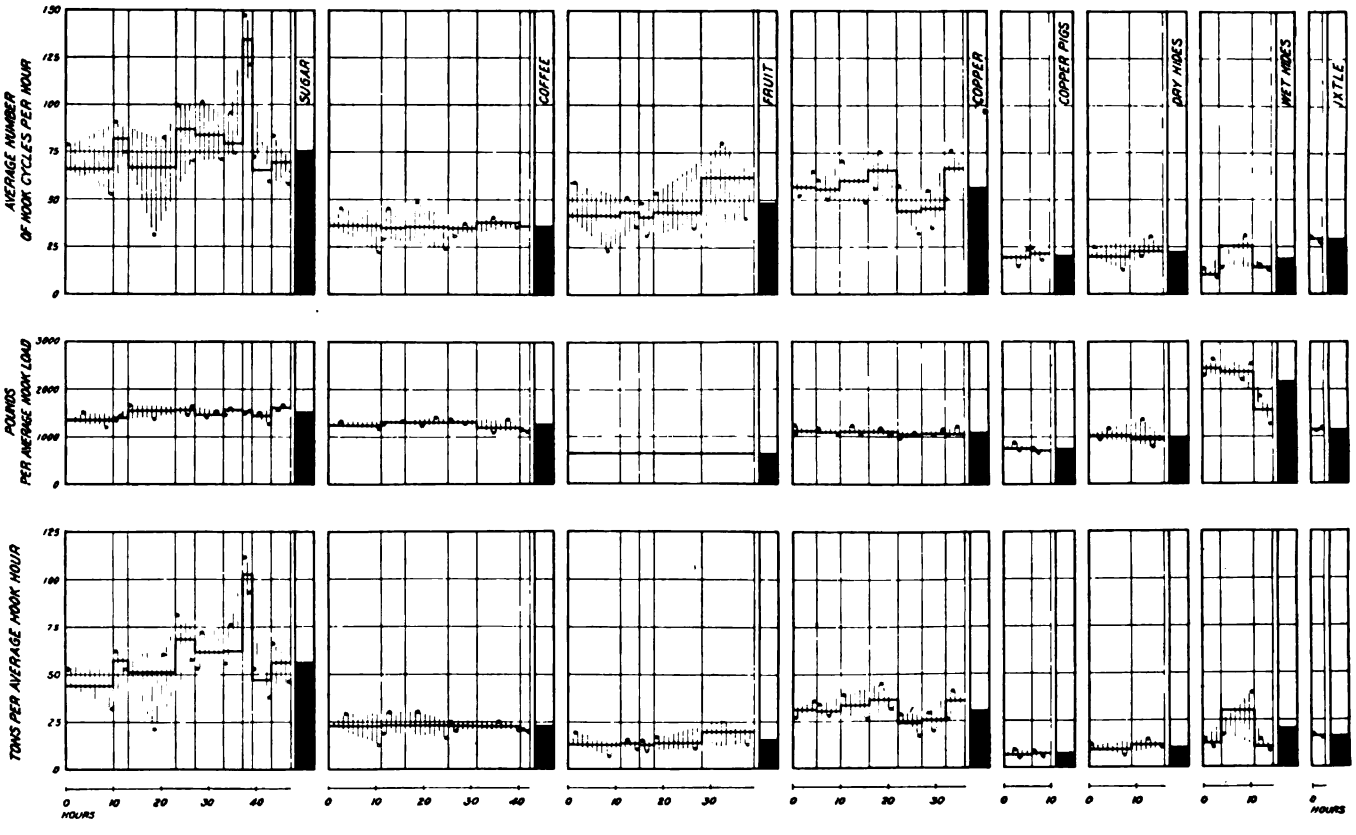


FIG. 23 — Hook Performances in Discharging of Eight Commodities — Number of Cycles per Hour, Average Load and Tonnage per Hook Hour

The average hook load for any one commodity varies within narrow limits. The single exception to this is wet hides.

As a result of the uniformity of hook loads, the average tonnage per hook-hour varies directly with the average number of hook cycles per hour.

Sugar shows the highest sustained average of hook cycles per hour (75.5), the highest average load (1,516 lb.) with the single exception of wet hides (2,177 lb.), and the highest average tonnage per hook-hour (56.23).

Sugar shows the best one-hour performance, with 111.85 tons discharged, this being followed by an hour in which 93.30 tons were discharged. This is the one instance in which two hooks working alternately were used during the two hours, and the record is strictly that of a hatch-hour rather than a hook-hour performance.

Sugar also shows the best ten-hour performance, 413.6 tons.

Copper makes the next best showing, with 56.72 hook cycles per hour at 1,090 lb. per hook, resulting in 30.91 tons discharged per hook-hour. The best hour for copper was 44.27 tons; the best average rate for six hours was 36.69 tons.

Wet hides show the next highest hourly rate (38.57 tons), due to the high hook load of 2,488 pounds.

Copper pigs show the lowest hourly rate, with 5.04 tons per hook hour.

Fig. 24, developed on the same basis as Fig. 23, covers the loading of fifteen commodities, the observation periods in general being shorter. Compared with discharging, outstanding features are as follows:

The average number of hook cycles was much lower for loading than for discharging. While three commodities, sugar, copper and fruit, were discharged with forty or more hook cycles per hour, no commodity was loaded with more than thirty-five, and in a majority of cases the average was less than twenty-five.

The average hook loads were greater for loading than for discharging. Of the fifteen commodities loaded, five averaged 2,000 lb. or more per hook.

With the exception of the discharging of sugar, there was no marked difference between the discharging and loading rates when expressed in tons per hook-hour. (It is noteworthy that sugar was also loaded at a higher rate than any other commodity, due chiefly to the large hook loads.)

In all of these diagrams the circles representing maximum and minimum performances are in their true hourly positions in the periods. It is worth noting that in the majority of cases, in both discharging and loading, the best hourly performance is toward the middle of the operation, while the poorest is either toward the end or at the very beginning. Data worked up roughly by the Commission's forces but not considered necessary to reproduce here show in many instances peaks in labor's efforts about the second hour after work is started or resumed after a meal, followed by a steady falling off until the next rest period.

Notes on Handling of Special Commodities

Sugar, Discharging — The commodity most rapidly discharged was sugar. As handled on the *E*, this was done by burtoning with ship's tackle, most of the time with a single hook between two ship's booms. During the two hours when the average number of cycles

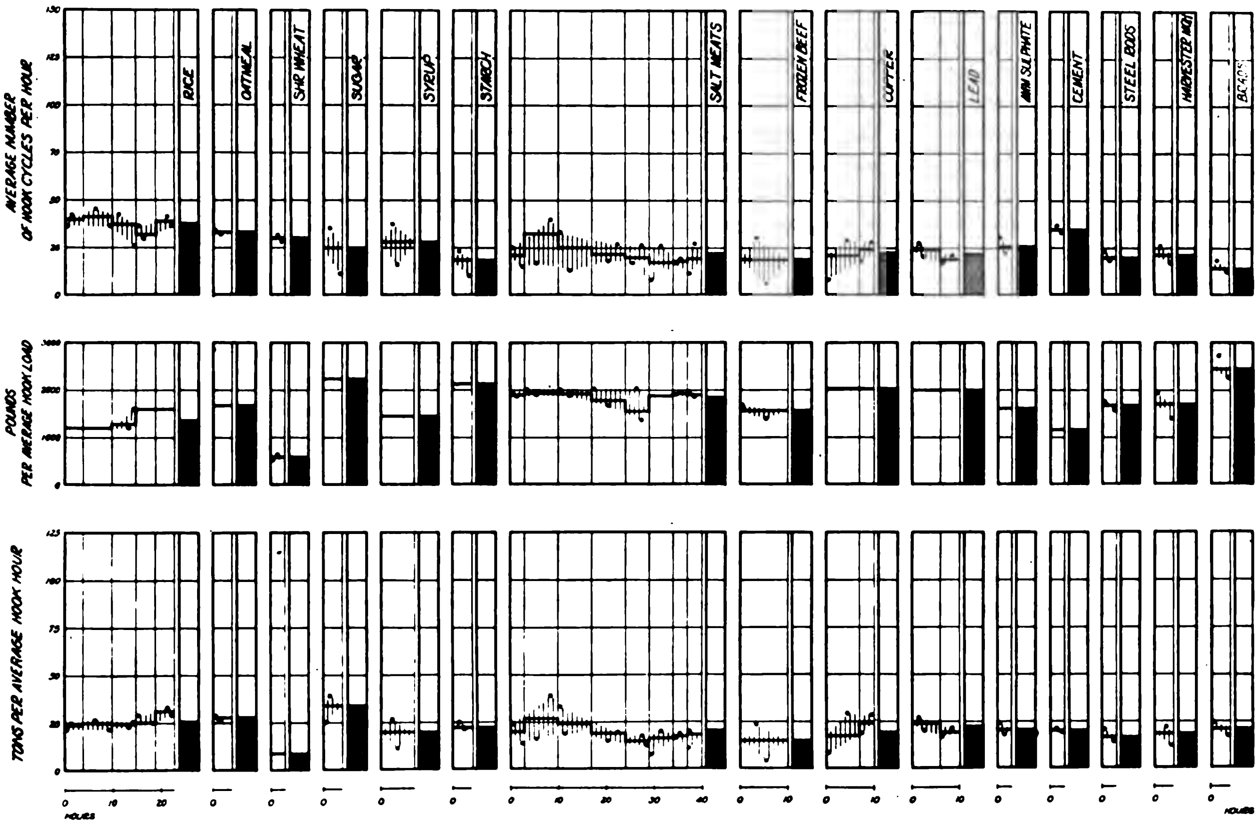


Fig. 24 — Hook Performances in Loading of Fifteen Commodities — Number of Cycles per Hour, Average Load and Tonnage per Hook Hour

exceeded 125 a cargo hoist was used, each boom carrying a hook and the two hooks being worked alternately through the hatch.

The sugar was lifted from the hold in a sling carrying five or six bags. It was handled from the pier platforms to the scales on hand trucks carrying three or four bags, and then hand trucked to the conveyor bins.

Coffee, Discharging — Coffee, as handled by the *V* and the *H*, came in bags and was ordinarily transferred about ten bags to the sling, and about 132 lb. to the bag. The bags were deposited on a temporary platform the height of a man's shoulders. Two men on the platform unhooked the slings and placed them, one by one, on the backs of the carriers. Enough men were employed as carriers to remove the bags as fast as they came from the hold. Other men, called cargo selectors, were stationed near the platform. It was their duty to observe the mark on each bag as it was deposited on the carrier's back, and call out by number the section of the pier to which the bag was to be taken. The cargo selectors were equipped with a chart of the piers showing the numbered sections of the pier.

Coffee was unloaded from the *V* at an average rate of 55 per cent faster than is shown in Fig. 23, but the performance is not included in the chart because the records, being those of the first ship clocked, did not afford sufficient detail.

Dry Hides, Discharging — The hides were placed in a net in the hold, dragged to the hatchway and lifted to the deck by ship's tackle. There was no trucking in the ship.

Frozen Beef, Loading — Frozen beef was loaded upon the *L* from car floats, frozen beef and bananas being the two commodities usually handled between car floats and ship direct. The cars were refrigerator cars on two-track floats with a center platform, but near the center of the track next to the ship had been placed a flat car. Two rope nets were spread on the floor of the flat car. A gang of men carried the beef quarters from the refrigerator cars and dropped them on one of the nets. Ten or twelve quarters constituted a draft, and the sling was raised over the sides with ship's gear and lowered through a hatch.

Salt Meat, Loading — Salt meat was loaded on the *L* by ship's tackle and slings from lighters. Hand trucking was necessary, but frequently the tackle dragged the cases to the lifting point. Some salt meat was trucked across the pier from lighters on the other side.

Syrup, Loading — Barrels handled in slings after being rolled across the pier from lighters.

Copper, Loading — Handled in slings from four-wheeled trucks on pier.

Figs. 23 and 24, showing speed performances, do not cover the loading of oil, flour or iron plates, but Figs. 20–22, which show costs, do, special study having been made of the loading of these three commodities from lighters to the *V*.

Oil, Loading — The oil came to the ship's side in a covered lighter, in cases weighing about 65 lb. each. A sling was placed on the floor of the lighter near the door, and the cases of oil were placed on the sling, eight cases to the draft. Ship's tackle handled the slings over the side. As the oil near the door of the lighter was removed, small four-wheeled trucks were brought into use. The sling was placed and loaded on the platform of a truck, which was pushed to the door of the lighter before the ship's tackle began lifting. The transfer took two hours at 17.5 long tons per hour.

Flour, Loading — Flour was handled in the same manner as oil, with four-wheeled trucks within the covered lighter. The sling carried from six to ten bags, with a total weight of about 1,150 lb. The transfer took 5¼ hours at 23.6 long tons per hour.

Iron Plates, Loading — Brought by a lighter equipped with a steam hoist. The tackle of the lighter and that of the ship were both hooked to each draft, the drafts averaging 6,453 lb. in weight. Eight men besides the captain and engineer of the lighter were engaged on it, their wages being taken into account in the right-hand branch of Fig. 22. The work was closely supervised by the boss stevedore. The plates were dropped directly under the hatch opening, men in the hold guiding the slings. Loading of general cargo from the pier was carried on simultaneously, and the same gang in the hold stowed the general cargo as it arrived.

MISCELLANEOUS CARGO

Besides the commodities covered in Figs. 23 and 24, numerous commodities handled in smaller quantities have been grouped under the heading of miscellaneous cargo. Fig. 25, following much the same form as Figs. 23 and 24, shows the loading records of miscellaneous cargo of six of the ships clocked and the discharging records of two. The loading diagrams cover some forty-two commodities — machinery, furniture, steel shapes, dairy products and other foodstuffs, tobacco, cotton, paper and less common products. The discharging diagrams cover ten commodities.

The chief characteristic of both the loading and the discharging operations is the wide range of fluctuations. This is shown by the wide separation of the solid and the open circle of each diagram — the circles in this case being placed in the center of the time interval.

The diagrams also illustrate the close relationship in the matter of miscellaneous cargo between weight of draft and number of cycles. The *G*, averaging upward of 5,000 lb. per draft, transferred only about fifteen drafts per hour, while the *E* transferred nearly seventy-five small drafts per hour, not, however, attaining as high a tonnage per hook-hour as the *G*.

OTHER NOTES ON SHIP CLOCKINGS

The cost of coaling the *V* from two barges is presented in Fig. 26. A total of 375 tons of coal was transferred, 250 tons from the *Louise* at a rate of 31¼ tons per hour, and 125 tons from the *Old Glory* at a rate of 38½ tons per hour.

In each case a gang of 29 men was employed. Because of the higher rate of speed attained on the *Old Glory* the cost per ton was somewhat less than on the *Louise*, although there was a much larger percentage of overtime — 29 per cent on the *Old Glory* and 6 per cent on the *Louise*.

The costs include an item, "Extra Hoist Hire," which covers the cost of hiring an outside hoisting engine to furnish the power for elevating coal buckets

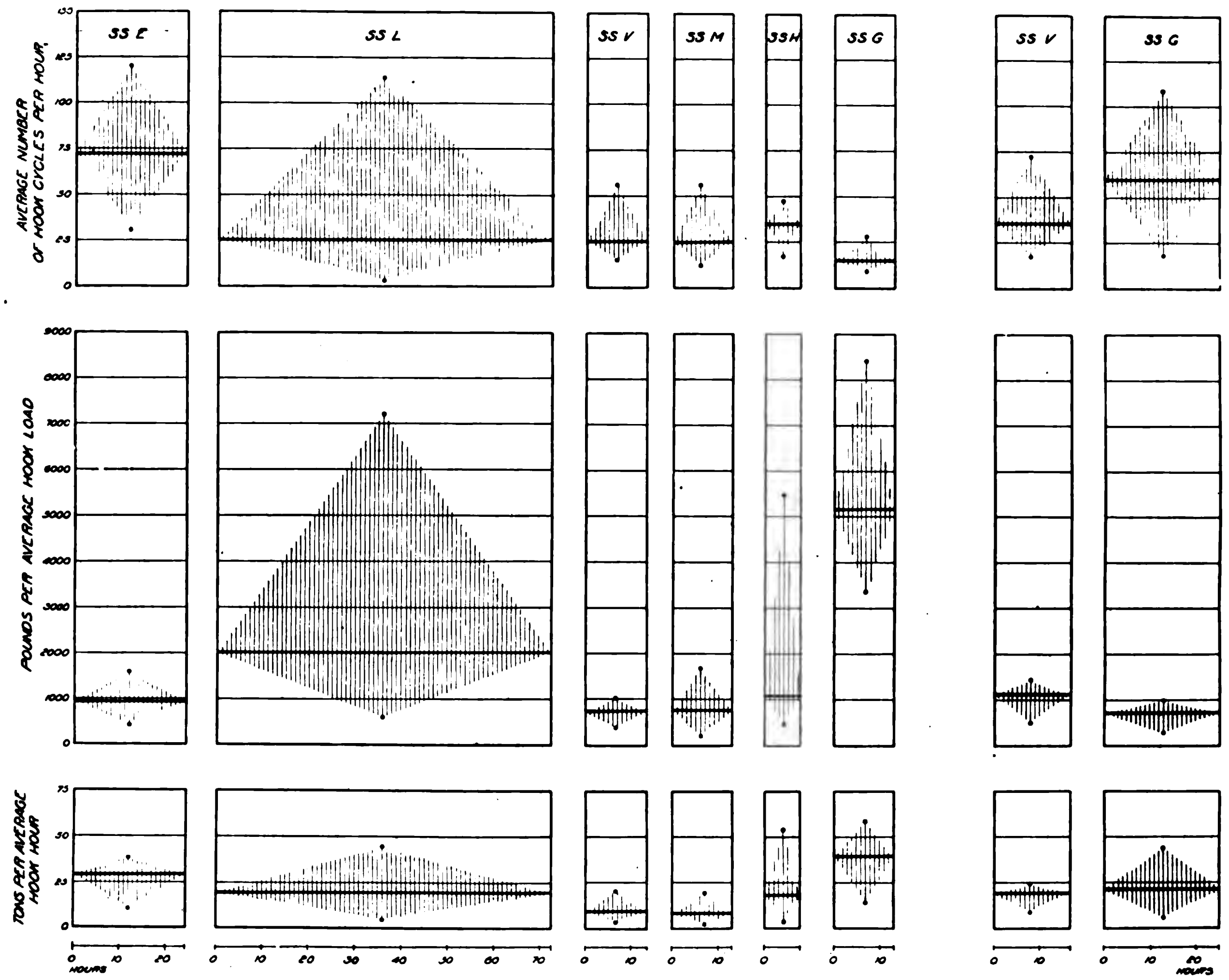


Fig. 25 — Hook Performances in Discharging of Miscellaneous Cargo from Six Ships and Loading of It to Two Ships

from the barges to the ship's coaling hatches. The rate charged for this hoist was $30 for an eight-hour day.

The steamship *G*, as previously noted, was representative of high speed in the loading and discharging of freight. She carried no passengers, and her oil-burning engines made it possible to use a large percentage of her internal space for cargo. Five large hatches, twelve side ports on each side and an abundance of winches all made for a rapid discharge or intake of cargo.

This vessel docked on a Thursday morning in February, 1919, at a Hudson River pier in Manhattan. Discharging was under way within two hours, most of the freight being trucked across the pier to lighters on the other side of it.

Working two days until 10 p. m. and the third day until 5.30 p. m., the ship was unloaded, some seventeen lighters receiving her cargo. The total load of 6,400 tons was discharged in 34½ hours, at a rate of 185 tons per hour. In loading the lighters, booms fixed to the pier shed and tackle operated by a movable winch and motor on the pier were frequently used.

The ship lay up over Sunday, and Monday morning loading began. Three days were required to load a cargo of 1,900 tons, owing to a strike of longshoremen called on the second day. Freight was loaded into the vessel from the pier, across the pier and to the side ports from some eight lighters on the opposite side and from lighters direct on the offshore side.

Of the inbound cargo 37 per cent was discharged upon the pier and 63 per cent across the pier to lighters. Of the outbound cargo 48 per cent was loaded direct

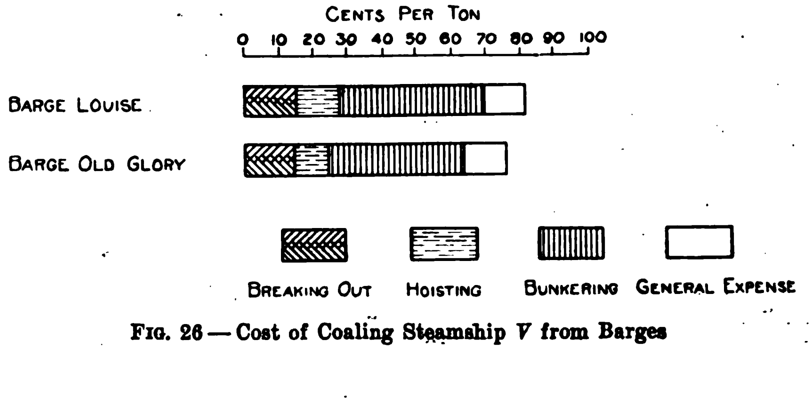


Fig. 26 — Cost of Coaling Steamship *V* from Barges

from the pier, 25 per cent across the pier from lighters and 27 per cent direct from lighters. On the average 320 men were engaged in the discharging operations and 195 in the loading.

Because of the strike the loading operations are not representative, and the figures have not been worked up in the same detail as in the cases of the *V* and the *M*. The rate of discharging, however, of 185 tons per hour may be compared with that of the *V* of 79 tons per hour and that of the *M* of 102 tons per hour.

The *G* had 95,975 gal. of oil in her tanks on her arrival in New York. While in port 11,033 gal. were consumed. On her northbound trip from Galveston 60,839 gal. were consumed, and 8,700 gal. were used at Galveston.

The steamship *L* docked at a Manhattan pier in the Hudson River on a Tuesday afternoon in March, 1919. She arrived without cargo, having carried troops from Liverpool to Halifax. On the evening of her arrival she began taking refrigerated meat from cars on a float alongside. The contents of thirty cars on three floats (390 tons) were transferred in this manner, the operation from one float after another being carried on almost continuously until midnight of the second night. Loading from the pier had meanwhile been started in the middle of the second day, and it was continued by day only for nine days.

In 87½ working hours 7,933 tons of cargo were loaded upon the ship, of which 2,970 tons or 38 per cent were loaded direct from the pier, 2,979 tons or 38 per cent across the pier from lighters and 1,984 tons or 24 per cent direct from lighters or car floats offshore. An average of 91 tons per hour was loaded. There were 225 men working and an average of 0.4 ton per hour per man was obtained.

Coaling was carried on for three working days from both sides of the ship, the ship being breasted off for the purpose. The ship contained 900 tons of coal in her bunkers upon arrival. She consumed 150 tons while in port, 2,650 tons were loaded upon her and she departed with 3,400 tons.

STEAMSHIPS *B* AND *D*

The steamships *B* and *D* were both in the New York and Boston service, operating from a typical Hudson River pier in Manhattan. The former was primarily a passenger ship, the latter exclusively a freighter. Both were side-port vessels, without hatches, hence there was no hoisting.

Both vessels were clocked for twelve hours, from 6 a. m. to 6 p. m. During that time the *B* arrived, discharged her cargo, was reloaded and departed. The *D*, which had already arrived, was unloaded and practically reloaded, although she took on a small additional amount of freight the following day and then departed.

During the observation period 594 tons of freight were unloaded from the *D*, 416 tons were loaded upon her and 100 tons of coal were placed in her bunkers; ¾ ton was unloaded from the *B*, 133½ tons were loaded upon her and 100 tons of coal were placed in her bunkers. In addition to this 67.8 tons of freight were loaded upon two lighters and 234.2 tons were unloaded from five lighters.

The direct costs per ton of these various operations as nearly as they could be determined from the single day's work are set forth in Table 14. These costs, like all others based on the clockings, are exclusive of such charges as maintenance, interest, depreciation and general administration.

TABLE 14 — DIRECT COSTS OF OPERATIONS AT TYPICAL PIER IN NEW YORK-BOSTON SERVICE BASED ON ONE DAY'S CLOCKINGS

	Tonnage transferred	Direct costs per ton			
		Breaking out	Trucking	Stowing	Total
Unloading *B* (passenger ship) to pier.	0.7	$1.413	$2.074	$0.114	$3.601
Unloading *D* (freighter) to pier.....	499	0.472	1.192	0.114	1.778
Unloading *D* to pier, trucking 600 ft. and loading lighter..............	31.2	0.472	3.833	0.473	4.778
Loading *B* from pier..............	119	0.097	0.659	0.345	1.101
Loading *D* from pier..............	179	0.097	0.253	0.283	0.633
Loading *D* across pier from lighter..	152	0.097	0.476	0.283	0.856
Loading *D* from lighter alongside ship	41	0.532	0.241	0.283	1.056
Loading lighter from pier deck with freight from other ships..........	27.6	0.114	2.791	0.473	3.378
Coaling *B* from barge alongside ship.	100	0.368	0.169	0.169	0.706
Coaling *D* from barge alongside ship.	100	0.360	0.155	0.155	0.670
All operations at pier..........	*1,049.5	......	......	......	1.595

* Payable tons (excluding coal)

As the question of transferring Sound steamships from the Hudson to the East River has arisen from time to time, a study of the effect on lighterage and trucking operations has been made. The results of this study are set forth in Tables 15–18. The pier at which steamships *B* and *D* dock in the Hudson River was chosen as one base, and an apparently available pier on the East River as the alternate base.

These tables show a distinct saving in both lighter and truck mileage in favor of the Hudson River location. Against this there would be a saving of 10½ miles of ship haul per round trip in favor of the East River location. At 8 miles per hour this would amount to a time saving of 1.31 hours per round trip. When it is considered that there are daily sailings for the passenger vessels, semi-weekly sailings for the

TABLE 15 — COMPARISON BETWEEN PERFORMANCES *Delivering Cargo by Lighters* TO STEAMSHIPS *B* AND *D* AT PRESENT HUDSON RIVER PIER AND AT A POSSIBLE EAST RIVER PIER

	Origin of lighter			
	New York	Brooklyn	New Jersey	Total
Number of lighters....................	1	1	6	8
Weight of cargo on lighter, tons........	4.5	193.6	274.3	472.4
Average weight per lighter, tons........	4.5	193.6	45.7	59.0
Total length of haul, miles.............	5.0	4.4	86.5	95.9
Length of haul to East River pier, miles..	7.9	6.7	115.6	130.2
Saving in favor of Hudson River pier, miles............................	2.9	2.3	29.1	34.3
Average haul per lighter, miles..........	5.0	4.4	14.4	11.9
Average haul to East River pier, miles....	7.9	6.7	19.3	16.3
Saving in favor of Hudson River pier,miles	2.9	2.3	4.9	4.4
Total amount of haul, ton-miles........	9.9	857.7	1,770.8	2,638.4
Amount of haul to East River pier, ton-miles...........................	18.9	1,295.2	3,213.0	4,527.2
Saving in favor of Hudson River pier, ton-miles............................	9.0	437.5	1,442.21	1,888.8

TABLE 16 — COMPARISON BETWEEN PERFORMANCES *Forwarding Cargo by Lighters* FROM STEAMSHIPS *B* AND *D* AT PRESENT HUDSON RIVER PIER AND AT A POSSIBLE EAST RIVER PIER

	Destination of lighter		
	New York	New Jersey	Total
Number of lighters forwarded from pier........	1	1	2
Weight of cargo on lighters, tons..............	58.9	11.9	70.8
Average weight per lighter, tons..............	58.9	11.9	35.4
Total length of haul, miles...................	1.6	4.0	37.0
Length of haul from East River pier, miles......	5.4	39.5	44.9
Saving in favor of Hudson River pier, miles.....	3.8	4.1	7.9
Average haul per lighter, miles...............	5.4	39.5	22.5
Average haul from East River pier, miles......	1.6	35.4	18.5
Saving in favor of Hudson River pier, miles.....	3.8	4.1	4.0
Total amount of haul, ton-miles..............	93.7	420.1	513.9
Amount of haul from East River pier, ton-miles.	318.3	469.1	787.4
Saving in favor of Hudson River pier, ton-miles.	224.6	49.0	273.5

freighters, short trips and regular ports of call, it is probable that the only appreciable saving would be materially less than the extra cost of lighterage and trucking operations.

These findings would, of course, change if different Hudson River and East River sites were selected. The information is given to show the degree of care which should be exercised in shifting the location of any particular business.

TIME STUDIES OF CRANE PERFORMANCES

In addition the foregoing clockings of typical discharging and loading performances of ships at piers, a number of time studies were made of the operations of certain of the cranes on open railroad piers on the New Jersey waterfront. The observations covered cranes of both the gantry and the locomotive type, employed in each case in transferring heavy pieces or special commodities direct from freight cars to ships. Because of the special nature of the operations, and the wide difference between them and the typical crane operations at the foreign ports that make most use of cranes, it is thought best not to present the figures in this report. They have been of use in the Commission's studies, and are available in the Commission's records.

EXISTING RECORDS OF SHIP PERFORMANCES

Existing records enabled the Commission to determine the costs in detail for the loading of ships only. The reason for this is that the discharging of the ships studied was done in each case under contract by stevedoring companies, at established rates, while the loading was done by the companies. This is a prevailing practice at both ends of the voyage, inasmuch as goods can satisfactorily be broken out of the hold and placed in accessible locations on the pier (the preponderance of goods being unloaded to the pier) by the outside stevedoring companies, whereas in loading the company prefers to assume the responsibility for so stowing its goods that they can be removed with a minimum of rehandling at the successive ports of call.

TABLE 17 — COMPARISON BETWEEN PERFORMANCES *Delivering Cargo by Street Trucks* TO STEAMSHIPS *B* AND *D* AT PRESENT HUDSON RIVER PIER AND AT A POSSIBLE EAST RIVER PIER

	Origin of trucks			
	New York	Brooklyn	New Jersey	Total
Number of trucks brought to pier	109	20	8	137
Weight of cargo on trucks, tons	169.03	65.61	11.67	246.31
Average weight per truck, tons	1.38	2.93	1.30	1.61
Total length of haul, miles	152.37	91.58	24.71	268.66
Length of haul to East River pier, miles	280.83	93.83	40.73	415.39
Saving in favor of Hudson River pier, miles	128.46	2.25	16.02	146.73
Average haul per truck, miles	1.40	4.58	3.09	1.96
Average haul to East River pier, miles	2.57	4.69	5.09	3.03
Saving in favor of Hudson River pier, miles	1.17	0.11	2.00	1.07

TABLE 18 — COMPARISON BETWEEN PERFORMANCES *Forwarding Cargo by Street Trucks* FROM STEAMSHIPS *B* AND *D* AT PRESENT HUDSON RIVER PIER AND AT A POSSIBLE EAST RIVER PIER

	Destination of truck			
	New York	Brooklyn	New Jersey	Total
Number of trucks brought from pier	224.00	46.00	22.00	292.00
Weight of cargo on trucks, tons	314.32	67.81	52.27	434.40
Average weight per truck, tons	1.25	1.31	2.13	1.33
Total length of haul, miles	420.47	346.64	38.26	805.37
Length of haul from East River pier, miles	646.40	337.22	102.95	1,086.57
Saving in favor of Hudson River pier, miles	225.72	*9.42	64.79	281.09
Average haul per truck, miles	1.88	7.53	1.74	2.76
Average haul from East River pier, miles	2.89	7.33	4.64	3.72
Saving in favor of Hudson River pier, miles	1.01	*0.20	2.90	0.96

* Saving in favor of East River pier.

From Fig. 9, Part IV, the number of hours each hatch was worked can be ascertained for each ship, and the total will represent the hatch hours consumed in loading. For each of these hatches there was used in almost every instance a single gang of men consisting on the average of somewhat under twenty longshoremen. In certain instances as extra gangs were used they have been added to the total number of hatch-hours to arrive at a correct figure for the number of gang-hours. In addition to the gang at work at each hatch, there is for each hatch a foreman, and usually all hatches are under the supervision of a head foreman called the stevedore. In arriving at the total man-hours used in loading, all men were counted except the head foreman for each vessel.

These totals and the reduction of them to tons per hatch-hour, per gang-hour and per man-hour are set forth in Table 19 for each ship. The table, which pertains to operations in 1913, can be compared with Table 13, which relates to operations in 1918.

TABLE 19 — SPEED AND COST OF LOADING OPERATIONS OF NINE STEAMSHIPS

Steamship	Hatch-hours worked	Gang-hours worked	Man-hours worked	Cargo loaded, long tons			
				Total	Per hatch-hour	Per gang-hour	Per man-h ur
China 1	634.0	634.0	10,227	7,668	12.09	12.09	0.75
India 1	444.0	473.5	8,366	7,567	17.04	15.98	0.90
Africa 2	342.0	392.0	6,989	6,050	17.69	15.43	0.86
Java 2	152.5	151.5	1,893	5,527	*36.24	*36.24	*3.11
Brazil 1	291.5	344.5	1,775.5	4,714	16.19	13.68	0.85
Africa 3	400.5	443.5	1,893	5,716	9.62	12.89	*3.00
Java 1	141.0	141.0	....	5,688	*40.34	40.34	....
Brazil 7	164.5	201.0	....	3,571	21.71	17.77	....
Brazil 4	229.0	265.0	....	6,224	27.18	23.49	....

* Cargo mainly case oil.

The high units for the *Java 1* and the *Java 2* are due to the fact that the entire cargoes with the exception of a very small amount of general cargo were case oil. Transferring this oil at the rate of three tons per man-hour necessitated a speed of between 75 and 100 cases per man-hour. Goods can ordinarily be moved faster in uniform packages, while greater speed was obtained with these cargoes by the use of a special arrangement of tackle.

In the cases of only six of these vessels was the number of man-hours determinable. The man-hours of those six are distributed by hatches in Table 20. Information was not available to show the corresponding amount of cargo loaded into the hatch.

Table 21 shows the actual number of men employed each day at each hatch at each of the several rates of

TABLE 20 — MAN-HOURS BY HATCHES CONSUMED LOADING SIX SHIPS

HATCH	*China 1*	*India 1*	*Africa 2*	*Java 2*	*Brazil 1*	*Java 1*
1	1,933.5	1,223.0	1,084.0	256.0	694.5	390
2	2,894.5	2,849.0	2,082.0	192.0	2,498.0	505
3	1,537.5	910.0	976.0	141.0	1,579.5	189
4	2,659.5	2,032.5	2,090.0	532.5	482.5	528
5	1,202.0	1,061.5	508.5	454.5	274.0	281
6	*	290.0	249.0	16.0	*	*
Total	10,227	8,366	6,989.5	1,775.5	5,528.5	1,893

* No sixth hatch recorded.
† Includes 183.5 man-hours allocated to the peak of the ship.

TABLE 21 — WAGE RATES AND LABOR EMPLOYED EACH DAY BY HATCHES IN LOADING THE *China 1* IN APRIL, 1913

WAGES, CENTS PER HOUR	Hatch 1			Hatch 2			Hatch 3			Hatch 4			Hatch 5		
	Men	Hours	Total wages	Men	Hours	Total wages	Men	Hours	Total wages	Men	Hours	Total wages	Men	Hours	Total wages
April 3															
33	12	120	$39.60	12	120	$39.60				12	120	$39.60			
40	3	30	12.00	3	30	12.00				3	30	12.00			
45	1	10	4.50	1	10	4.50				1	10	4.50			
50				1	10	5.00									
Total	16	160	$56.10	17	170	$61.10				16	160	$56.10			
April 4															
30										1	10	$3.00			
33	12	18	$5.94	12	120	$39.60				12	120	39.60			
40	3	4½	1.80	3	30	12.00				3	30	12.00			
45	1	5	2.25	1	10	4.50				2	15	6.75			
50				1	10	5.00									
Total	16	27½	$9.99	17	170	$61.10				18	175	$61.35			
April 5															
30										1	10	$3.00			
33				12	108	$35.64				13	91	30.03			
40				3	27	10.80				3	21	8.40			
45				1	10	4.50				1	10	4.50			
50				1	10	5.00									
Total				17	155	$55.94				18	132	$45.93			
April 7															
30										1	10	$3.00			
33				12	120	$39.60				13	121	39.93	1	10	$3.30
40				3	30	12.00				3	30	12.00	10	100	40.00
45				1	10	4.50				2	20	9.00	6	60	27.00
50				1	10	5.00									
Total				17	170	$61.10				19	181	$63.93	17	170	$70.30
April 8															
30				1	10	$3.00									
33	11	110	$36.30	12	96	31.68	12	70	$23.10	12	53½	$17.66	1	10	$3.30
40	3	30	12.00	3	24	9.60	3	18	7.20	3	15	6.00	8	72	28.80
45	1	10	4.50	1	10	4.50	1	5	2.25	1	5	2.25	6	60	27.00
50	1	10	5.00												
Total	16	160	$57.80	17	140	$48.78	16	93	$32.55	16	73½	$25.91	15	142	$59.10
April 9															
30	1	10	$3.00												
33	11	105	34.65	11	110	$36.30	11	110	$36.30				1	6	$1.98
40	3	30	12.00	3	30	12.00	3	30	12.00				8	48	19.20
45	1	10	4.50	1	10	4.50	1	10	4.50				6	35	15.75
50				1	10	5.00									
Total	16	155	$54.15	16	160	$57.80	15	150	$52.80				15	89	$36.93
April 10															
30	1	10	$3.00												
33	11	105	34.65	11	110	$36.30	11	81½	$26.90	16	42	$13.86	1	10	$3.30
40	3	30	12.00	3	30	12.00	3	24	9.60	3	8	3.20	8	80	32.00
45	1	10	4.50	1	10	4.50	1	5	2.25	1	5	2.25	6	60	27.00
50				1	10	5.00									
Total	16	155	$54.15	16	160	$57.80	15	110½	$38.75	20	55	$19.31	15	150	$62.30
April 11															
30										1	10	$3.00			
33	11	55	$18.15	11	93½	$30.86				10	80	26.40	8	56	$18.48
40	3	15	6.00	3	25½	10.20				3	24	9.60	5	40	16.00
45	1	10	4.50	1	10	4.50				1	10	4.50	6	50	22.50
50				1	10	5.00									
Total	15	80	$28.65	16	139	$50.56				15	124	$43.50	19	146	$56.98
April 12															
30				1	10	$3.00									
33				10	90	29.70	10	40	$13.20	18	122½	$40.43	8	40	$13.20
40				3	27	10.80	3	16	6.40	3	26	10.40	5	25	10.00
45				1	10	4.50	1	10	4.50	1	10	4.50	6	35	15.75
50				1	10	5.00									
Total				16	147	$53.00	14	66	$24.10	22	158½	$55.33	19	100	$38.95
April 14															
30				1	10	$3.00									
33	11	88	$29.04	10	100	33.00	16	145	$47.85	15	124	$40.92	8	16	$5.28
40	3	24	9.60	3	30	12.00	3	30	12.00	3	30	12.00	5	8	3.20
45	1	10	4.50	1	10	4.50	1	10	4.50	1	10	4.50	5	10	4.50
50				1	10	5.00									
Total	15	122	$43.14	16	160	$57.50	20	185	$64.35	19	164	$57.42	18	34	$12.98
April 15															
30										1	10	$3.00			
33	10	50	$16.50	16	120	$39.60				10	75	24.75	7	50	$16.50
40	3	15	6.03	3	22½	9.00				3	22½	9.00	5	35	14.00
45	1	10	4.50	1	10	4.50				1	10	4.50	6	45	20.25
50				1	10	5.00									
Total	14	75	$27.00	21	162½	$58.10				15	117½	$41.25	18	130	$50.75

TABLE 21 — WAGE RATES AND LABOR EMPLOYED EACH DAY BY HATCHES IN LOADING THE *China 1* IN APRIL, 1913

WAGES, CENTS PER HOUR	Hatch 1			Hatch 2			Hatch 3			Hatch 4			Hatch 5		
	Men	Hours	Total wages	Men	Hours	Total wages	Men	Hours	Total wages	Men	Hours	Total wages	Men	Hours	Total wages
April 16															
30	......	......	....	......	......	....	......	......	....	1	5	$1.50	1	5	$1.50
33	......	......	....	......	......	....	......	......	....	8	16	5.28	8	51	16.83
40	......	......	....	......	......	....	......	......	....	5	10	4.00	5	35	14.00
45	......	......	....	......	......	....	......	......	....	6	12	5.40	6	43	19.35
50	......	......	....	......	......	....	......	......	....	1	5	2.50	1	5	2.50
Total	......	......	....	......	......	....	......	......	....	21	48	$18.68	21	139	$54.18
April 17															
30	......	......	....	......	......	....	......	......	....	1	10	$3.00	......	......	....
33	11	100	$33.00	16	145	$47.85	19	176	$58.08	11	100	33.00	......	......	....
40	3	30	12.00	3	30	12.00	3	30	12.00	3	30	12.00	......	......	....
45	1	10	4.50	1	10	4.50	1	10	4.50	1	10	4.50	......	......	....
50	1	10	5.00	......	......	....	......	......	....	......	......	....	......	......	....
Total	16	150	$54.50	20	185	$64.35	23	216	$74.58	16	150	$52.50	......	......	....
April 18															
30	......	......	....	......	......	....	......	......	....	1	10	$3.00	......	......	....
33	16	125	$41.25	11	110	$36.30	16	80	$26.40	10	100	33.00	......	......	....
40	3	30	12.00	3	30	12.00	3	15	6.00	3	30	12.00	......	......	....
45	1	10	4.50	1	10	4.50	1	5	2.25	1	10	4.50	......	......	....
50	......	......	....	1	10	5.00	......	......	....	......	......	....	......	......	....
Total	20	165	$57.75	16	160	$57.80	20	100	$34.65	15	150	$52.50	......	......	....
April 19															
30	......	......	....	......	......	....	......	......	....	1	10	$3.00	......	......	....
33	16	143	$47.19	16	126	$41.58	......	......	....	10	95	31.35	7	42	$13.86
40	3	27	10.80	3	27	10.80	......	......	....	3	28½	11.40	5	30	12.00
45	1	10	4.50	1	10	4.50	......	......	....	1	10	4.50	6	35	15.75
50	......	......	....	1	10	5.00	......	......	....	......	......	....	......	......	....
Total	20	180	$62.49	21	173	$61.88	......	......	....	15	143½	$50.25	18	107	$41.61
April 21 (Day)															
30	......	......	....	......	......	....	......	......	....	1	10	$3.00	......	......	....
33	8	80	$26.40	15	134½	$44.39	16	150	$49.50	10	95	31.35	......	......	....
40	5	50	20.00	3	30	12.00	3	30	12.00	3	28½	11.40	......	......	....
45	6	60	27.00	1	10	4.50	1	10	4.50	1	10	4.50	......	......	....
50	......	......	....	1	10	5.00	......	......	....	......	......	....	......	......	....
Total	19	190	$73.40	20	184½	$65.89	20	190	$66.00	15	143½	$50.25	......	......	....
April 21 (Night)															
40	......	......	....	......	......	....	......	......	....	1	5	$2.00	......	......	....
50	......	......	....	......	......	....	......	......	....	10	40	20.00	......	......	....
60	......	......	....	......	......	....	......	......	....	3	12	7.20	......	......	....
65	......	......	....	......	......	....	......	......	....	1	5	3.25	......	......	....
75	......	......	....	......	......	....	......	......	....	1	5	3.75	......	......	....
Total	......	......	....	......	......	....	......	......	....	16	67	$36.20	......	......	....
April 22 (Day)															
30	......	......	....	1	10	$3.00	......	......	....	......	......	....	......	......	....
33	16	160	$52.80	8	76	25.08	17	161½	$53.30	10	95	$31.35	......	......	....
40	3	30	12.00	3	28½	11.40	3	28½	11.40	3	28½	11.40	......	......	....
45	1	10	4.50	1	10	4.50	1	10	4.50	1	10	4.50	......	......	....
50	......	......	....	1	10	5.00	......	......	....	......	......	....	......	......	....
Total	20	200	$69.30	14	134½	$48.98	21	200	$69.20	14	133½	$47.25	......	......	....
April 22 (Night)															
40	......	......	....	......	......	....	......	......	....	1	5	$2.00	......	......	....
50	......	......	....	17	68	$34.00	......	......	....	10	40	20.00	......	......	....
60	......	......	....	3	12	7.20	......	......	....	3	12	7.20	......	......	....
65	......	......	....	1	5	3.25	......	......	....	1	5	3.25	......	......	....
75	......	......	....	......	......	....	......	......	....	1	5	3.75	......	......	....
Total	......	......	....	21	85	$44.45	......	......	....	16	67	$36.20	......	......	....
April 23 (Day)															
30	1	10	$3.00	......	......	....	......	......	....	......	......	....	......	......	....
33	16	96	31.68	16	128	$42.24	17	181	$59.73	16	160	$52.80	......	......	....
40	3	18	7.20	3	28½	11.40	3	34½	13.80	3	34½	13.80	......	......	....
45	1	10	4.50	1	10	4.50	1	11½	5.15	1	11½	5.15	......	......	....
50	......	......	....	1	10	5.00	......	......	....	......	......	....	......	......	....
Total	21	134	$46.38	21	176½	$63.14	21	227	$78.68	20	206	$71.75	......	......	....
April 23 (Night)															
40	......	......	....	1	5	$2.00	......	......	....	......	......	....	......	......	....
50	......	......	....	12	30	15.00	......	......	....	17	42½	$21.25	......	......	....
60	......	......	....	3	7½	4.50	......	......	....	3	7½	4.50	......	......	....
65	......	......	....	1	5	3.25	......	......	....	1	5	3.25	......	......	....
75	......	......	....	......	......	....	......	......	....	1	5	3.75	......	......	....
94	......	......	....	1	5	4.70	......	......	....	......	......	....	......	......	....
Total	......	......	....	18	52½	$29.45	......	......	....	22	60	$32.75	......	......	....
April 24															
30	......	......	....	......	......	....	......	......	....	1	10	$3.00	......	......	....
33	......	......	....	21	120	$39.60	......	......	....	21	121½	40.10	......	......	....
40	......	......	....	3	24	9.60	......	......	....	3	24	9.60	......	......	....
45	......	......	....	1	10	4.50	......	......	....	1	10	4.50	......	......	....
50	......	......	....	1	10	5.00	......	......	....	......	......	....	......	......	....
Total	......	......	....	26	164	$58.70	......	......	....	26	165½	$57.20	......	......	....

pay in loading the *China 1,* and the total labor costs. The few men at the 30-cent rate were probably deckmen, the 33-cent men were the ordinary longshoremen, the 40-cent men the gang foremen, the 45-cent men the hatch foremen, and the 50-cent man was the general foreman of the entire loading operation.

It should be borne in mind that wages have increased greatly since 1913, when this loading operation was performed. The general proportion of men of the different classes employed and the relationship of their wage scale have remained about the same.

The total labor cost of loading 7,668 tons is seen to have been $3,825.52, making the average cost slightly under 50 cents per ton.

The missing dates in Table 21 represent Sundays, on which no work was done. During the last week, however, night work was performed on Hatches 2 and 4, the rate being about 50 per cent in excess of the day rate.

Table 22 is presented to indicate the general manner in which stevedoring charges are established, show the difficulty because of the several units employed in arriving at any reliable estimates of average stevedoring charges, and give some idea of the relative rate for discharging and loading. This schedule covers the trip of the *China 1* referred to in the previous pages. In the case of the inward cargo, which was unloaded by an outside stevedoring company, the table presents the actual costs to the company; in the case of the outward, which was handled by the parent steamship company, it shows the bookkeeping charges against the particular subsidiary company operating the *China 1* — charges which are supposedly intended to embrace all of the labor costs shown in Table 21, together with the necessary incidentals and the fixed margin of profit.

TABLE 22 — STEVEDORING CHARGES COVERING TURNAROUND OF THE *China 1*

KIND OF CARGO	Weight tons	Measurement tons	Payable tons	Bales	Rate	Amount
			Inward			
Hemp	......	....	....	20,925	$0.05	$1,046.25
General	......	327	327	....	.20	65.40
General	......	1,756	1,756	....	.33	579.48
Gambier	......	150	150	....	.35	52.50
Tin	325	....	325	....	.30	97.50
Total	325	2,233	2,558	20,925	....	$1,841.13
Average per payable ton, exclusive of hemp					$.311	....
			Outward			
General	769	4,197½	4,966½	....	$0.35	$1,738.28
Heavy lifts	36	375½	411½	....	.50	205.75
Structural	312	367½	679½	....	.50	339.75
Rails	2,362	....	2,362	....	.40	944.80
Hogsheads of tobacco	......	280	280			
Domestics	......	976½	976½	....	.35	572.78
Rosin	......	380	380			
Locomotives	40½	107½	148	....	.50	74.00
Car material	2	11½	13½	....	.45	6.08
Cotton	......	....	....	1,432	.16	229.12
Total	3,521½	6,696	10,217½	1,432	....	$4,110.56
Average per payable ton, exclusive of cotton					$.380	

In Table 22 we find stevedoring of general cargo charged for both by weight and by measurement tons, and the same is true of some of the other items. On the other hand hemp and cotton were not charged for by tons, but by bales. If 11,183 payable tons (Table 10, page 182) were carried on the outward voyage of the *China 1,* the general average charge for stevedoring, including the cotton, was 36.8 cents per payable ton, as compared with 38.0 cents exclusive of cotton.

REDUCING LAY PERIODS BY MORE CONTINUOUS WORK

A study was made of the possibility of reducing the period a ship spends in port by more continuous transferring operations.

The hatches are not all worked to capacity even during working hours for the period that the vessel is at the pier. The clockings sustain this assertion. Considerable nonproductive time of the ship could be saved if the full working day were utilized. Still more could be saved if operations were carried on day and night except Sundays, and of course the maximum despatch would be obtained if the work were carried on continuously, including Sundays.

TABLE 23 — SAVING POSSIBLE IN DAYS IN LOADING PERIODS OF NINE SHIPS IF LOADING HAD BEEN MORE CONTINUOUS

VESSEL	Actual lay period for loading	Necessary period if all hatches had been worked		
		Full 10-hour days	24 hours daily except Sunday	24 hours daily
China 1	22.13	21.00	8.50	7.50
India 1	17.38	15.21	5.63	5.63
Africa 1	14.00	11.15	4.31	4.31
Java 2	19.97	4.00	1.67	1.67
Brazil 1	12.21	17.21	6.21	5.21
Africa 3	10.34	10.02	4.75	3.75
Java 1	16.18	4.02	1.69	1.69
Brazil 7	12.96	8.13	4.04	3.04
Brazil 4	10.45	9.17	3.50	3.50

Table 23 shows what would have been the possibilities in this respect with regard to the nine ships studied from the records, and Fig. 27 shows the same

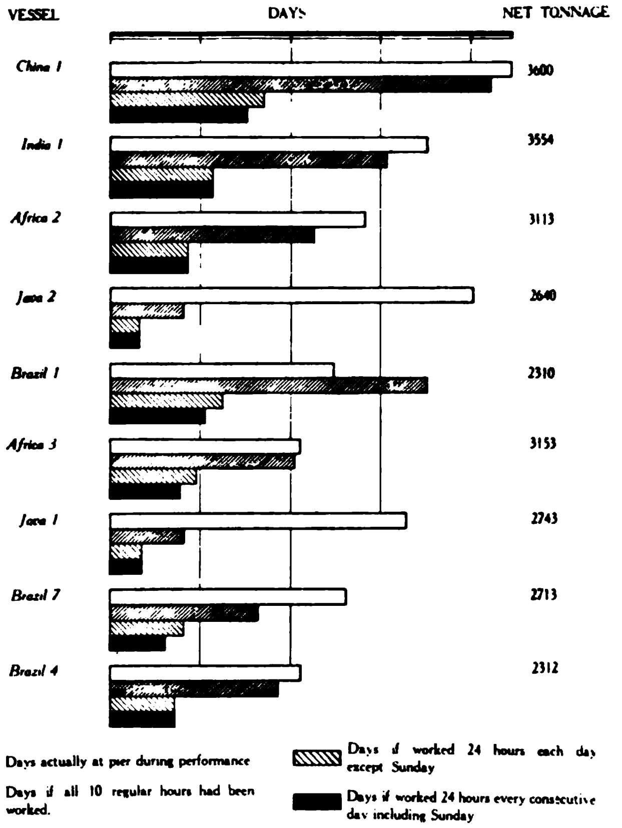


FIG. 27 — Time Used Loading Nine Ships Compared with Shorter Periods Possible if More Continuous Operation were Employed

information graphically. Table and diagram are worked up on the basis of ten-hour days, since those were the standard in 1913. The present standard day is eight hours.

In the single case of the *Brazil 1* the second bar is longer than the first for the reason that considerable overtime was employed in the loading of that ship.

Of course inadequacy of floor space, unfavorable conditions on the pier or in the slip, the state of the weather or failure of shippers to get their cargo to the ship on time may have had much to do with the relatively small proportions of the total time available utilized. Serious consideration should, however, be given to the matter of matching the extra cost of night and overtime labor with the fixed charges against the idle ship.

In conjunction with the question of reducing the time of turnaround, the number of days that cargo is at the pier, particularly the number of days it is there before the ship's arrival, may be presented. At one of the piers specially studied this record was kept for all outbound steamers of a particular line for a number of years, so that fairly representative averages have been derived of the total number of days the vessel used the pier to load, the total number of days the outward cargo was on the pier and the time the cargo was on the pier before the ship's arrival. This third and last item is usually, under bad conditions, a factor in the congestion.

The information is presented in the form of averages in Table 24. Under normal conditions a week and a half usually elapses after the cargo has been brought to the pier before the vessel arrives for loading or is fully unloaded and ready to be loaded. The low average of 4.1 for seventeen vessels in 1914 may have been due to several causes, but it seems likely that it was due to restrictions placed by the company limiting the free time before the vessel sailed.

TABLE 24 — AVERAGE LAY PERIOD IN DAYS FOR SHIPS AND CARGOES IN THE INDIA TRADE AT PIER 501

YEAR	Number of ships	Average number of days		
		A ship was at pier ready to load	Outward cargo was on pier	Cargo was on pier before ship was ready to load
1910	22	7.6	19.9	12.6
1911	30	6.8	21.6	13.3
1912	25	12.1	20.1	9.8
1913	23	11.9	22.1	9.9
1914	17	12.4	16.6	4.1
Average	23	9.9	20.5	10.2

The individual ships show wide fluctuations from the averages. Four of the ships in the five years required only a day each for loading. The majority in 1910 and 1911 were at the pier for loading not to exceed three days, although the record was not so good in the later years. In the main, however, the averages are forced up by a small number of ships each year at the pier to load from two to four weeks.

During the five years there were just three instances in which the cargo was on the pier only two days and the ship loaded in an equal or shorter period. In most instances, even where the ship loaded in three or four days, the cargo was there two weeks or more, and in a few cases it was there forty or fifty days.

Pier Performance

In an attempt to arrive at a criterion of performance in order to compare different piers, four units have been employed as follows:

1. Number of tons per year per linear foot of berthing space handled over the pier itself, derived by dividing the total tonnage passing over the pier itself in any given year by the total length of stringpiece used in the docking of vessels — this in all cases covering only side wharfage.
2. Number of tons per year per square foot of pier-floor area, derived by dividing the total tonnage passing over the pier itself in any given year by the pier-floor area.
3. Number of tons per year per linear foot of berthing space, as in the case of the first unit, but based on the total tonnage handled at the pier, which includes in addition to that handled over the pier that transferred between ship and lighter direct.
4. Number of tons per year per square foot of pier-floor area, based on the total tonnage handled at the pier, whether over the pier or between ship and lighter direct.

No deductions were made in any instance for columns, aisles, office space or the storing of pier equipment. These vary so widely with different piers, methods of operation, seasonal conditions, commodities and other factors that it was thought impracticable to make any exact allowance for them.

While the piers selected were well managed, busy piers and fairly representative of present harbor practice, care must be exercised if the deduced tonnage per linear foot or per square foot is to be applied to pier design in order to predict the tonnage that may be handled over any particular pier. The pier may be too long or too short, too narrow or too wide. It may have a one-story shed or a two-story shed. The character of the freight may vary. Intimate knowledge of the business to be handled in every detail is necessary for intelligent design. The figures that follow in terms of the four units are presented principally for the purpose of comparison, although properly used they have other value.

PIER 501

The best records pertaining to pier operations were encountered for the pier designated in this report as Pier 501. Complete records for six consecutive years, the first three of which were pre-war, were available in detail.

Table 25 shows the performance of this pier for six years, 1911 to 1916 inclusive, in cargo tons of 2.240 lb. each. The table includes the cargo handled directly by lighter over the offshore sides of the vessels as well as that handled on the pier itself.

The averages for the six consecutive years show that approximately three and one-half times as much cargo went out as came in. In other words, the outward movement was 77.5 per cent and the inward only 22.5 per cent of the total. The predominance of the outward movement and its progressive increase are shown graphically in Fig. 28. The predominance itself as

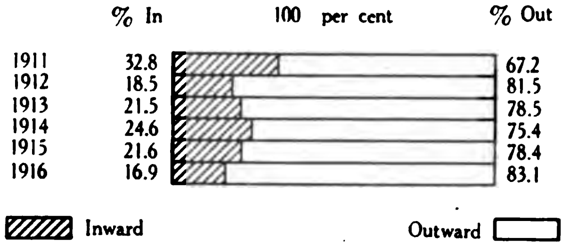


FIG. 28 — Proportion of Inward and Outward Tonnage to Total Tonnage Handled at Pier 501

well as its progressive increase is probably the result of two causes — an unbalanced movement over this particular facility and the gradual conversion of the pier into one for loading only, at which vessels would dock after they had discharged part or all of their cargo at other piers in the harbor operated by the same company.

Fig. 29 shows graphically the information in Table 25.

In Table 26 we have a separation of the tonnages of Table 22 according as they were handled over the pier or to or from lighters offshore. The same information is presented graphically from several angles in Figs. 30–32. Fig. 35, page 211, is an amplification of Fig. 30 showing the data by months.

Nearly as much of the total cargo inward and outward was handled by lighters offshore as by all means over the pier, and considerably more of the outward movement was handled by lighters. (It will be shown presently that a large part of the cargo handled over the pier was brought to it by lighters.) On the other hand, only a small percentage of the inward cargo was discharged to lighters on the offshore side.

The explanation for this is easily found. Outward cargo is stowed on a ship by ports of destination. There may be only one. In extreme cases there are as many as thirty, but the average is about seven. Shipments large enough to load a lighter may readily be made up at the New Jersey or other waterfront yards and transferred bodily into the hold of the vessel. Inward cargo, however, is destined for a large number of consignees. Except in the case of a comparatively small number

TABLE 26 — TONNAGES OF TABLE 25 SEPARATED INTO AMOUNTS HANDLED OVER PIER AND ON OFFSHORE SIDE BY LIGHTERS DIRECT

	Discharged inward		Loaded outward		Total	
YEAR	To pier	To lighters offshore	From pier	From lighters offshore	Over pier	By lighters offshore
1911........	231,313	1,908	190,564	287,336	421,877	289,244
1912........	130,909	3,887	296,991	295,416	427,900	299,303
1913........	152,248	16,952	264,390	353,518	416,638	370,470
1914........	170,409	10,708	219,546	336,879	389,955	347,587
1915........	177,145	13,050	217,573	471,669	394,718	484,719
1916........	98,386	30,194	224,703	409,113	323,089	439,307
Average.....	160,068	12,783	235,628	358,988	395,696	371,771

TABLE 25 — TONNAGES BY YEARS HANDLED AT PIER 501

YEAR	Inward	Outward	Total
1911......	233,221	477,900	711,121
1912......	134,796	592,407	727,203
1913......	169,200	617,908	787,108
1914......	181,117	556,425	737,542
1915......	190,195	689,242	879,437
1916......	128,580	633,816	762,396
Average...	172,852	594,616	767,468

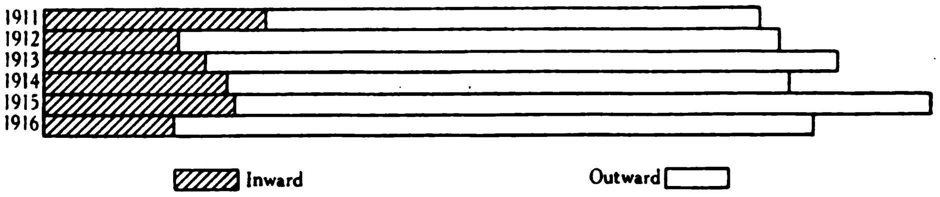


FIG. 29 — Total Tonnage Handled at the Pier Divided to Show Inward and Outward Amounts

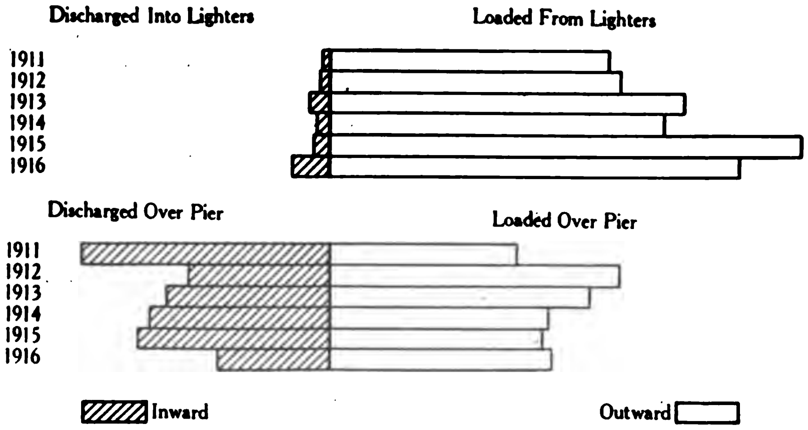


FIG. 30 — Tonnage Divided to Show the Inward and Outward Movements

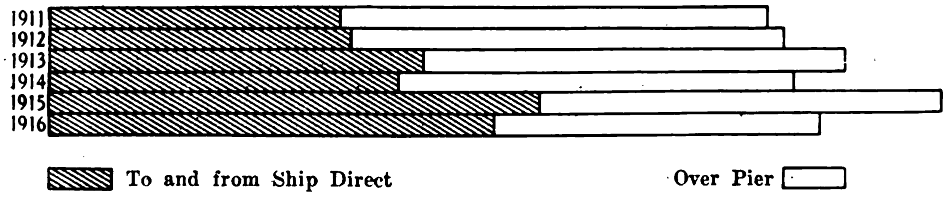


FIG. 31 — Total Tonnage Handled at the Pier Divided to Show Amount Passing Over the Pier and that which was Floated to and from the Ship Direct by Lighters

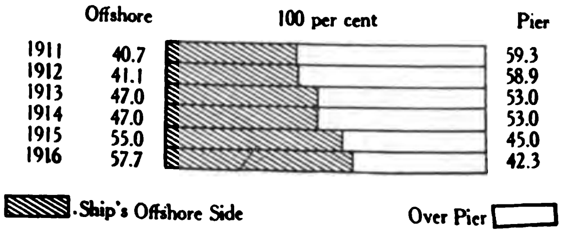


FIG. 32 — Proportions of Total Tonnage Moved *Over* the Pier and Floated Direct To and From the Ship

of large shipments, it requires assorting before it can be forwarded from the ship. The natural place for this assorting is the deck of the pier. Most of the inward cargo therefore is discharged upon the pier and then removed by drays, cars, lighters or other means.

It is possible still further to separate both the inward and the outward tonnage handled over the pier. The records for Pier 501 were kept in such form that it was possible to segregate the tonnage to show the amount that left the pier on the inward land movement in railroad cars, in street trucks and via lighter, and also that destined for immediate local storage in warehouses. This has been done in Table 27.

The outward tonnage appears in Table 28, and it will be noted that in the assembling of the cargo by the land carriers none was received at the pier from "warehouses." The steamship company in tabulating these figures probably restricted the term warehouses to refer to those only in the general vicinity of the pier — such tonnage as was received from and destined to distant points in the city being entered under the heading of "trucks." That which was delivered directly to near-by warehouses was handled by hand trucks, small auto trucks or tractors and trailers. The table is made up in the same form as Table 27, although no tonnage comes under the warehouse column.

TABLE 27 — DISPOSITION OF INWARD CARGO UNLOADED FROM SHIPS UPON PIER 501 — TONNAGES DELIVERED TO CARS, TRUCKS, WAREHOUSES AND LIGHTERS

YEAR	To cars	To trucks	To warehouses	To lighters from pier	Total
1911..........	35,352	40,619	26,321	129,021	213,313
1912..........	20,860	24,787	17,355	67,907	130,909
1913..........	29,238	26,754	23,619	72,637	152,248
1914..........	34,416	19,952	17,894	98,147	170,409
1915..........	36,714	32,864	23,862	83,705	177,145
1916..........	10,701	16,187	13,971	57,527	98,386
Average.......	27,880	26,860	20,503	84,824	160,068

TABLE 28 — ORIGIN OF OUTWARD CARGO LOADED UPON SHIP OVER PIER 501 — TONNAGES RECEIVED FROM CARS, TRUCKS, WAREHOUSES AND LIGHTERS

YEAR	From cars	From trucks	From warehouses	From lighters over pier	Total
1911..........	6,110	71,441	0	113,013	190,564
1912..........	52,183	96,363	0	148,445	296,991
1913..........	29,188	59,749	0	175,453	264,390
1914..........	24,218	31,815	0	163,513	219,546
1915..........	37,573	44,331	0	135,669	217,573
1916..........	18,815	91,389	0	114,499	224,703
Average.......	28,014	65,848	0	141,765	235,627

TABLE 29 — TONNAGES OF INWARD AND OUTWARD CARGO LOCALLY DELIVERED VIA LAND AND WATER, PIER 501

YEAR	Inward		Outward		Total	
	Via land	Via water	Via land	Via water	Via land	Via water
1911........	102,292	130,929	77,551	400,349	179,843	531,278
1912........	63,002	71,794	148,546	443,861	211,548	515,655
1913........	79,611	89,589	88,937	528,971	168,548	618,560
1914........	72,262	108,855	56,033	500,392	128,295	609,247
1915........	93,440	96,755	81,904	607,338	175,344	704,093
1916........	40,859	87,721	110,204	523,612	151,063	611,333
Average.....	75,244	97,607	93,863	500,754	169,107	598,361

Here again we can more easily visualize the statistical data by changing them to graphical form. The data in these two tables are presented on a percentage basis in Fig. 33, the sums of the four sections opposite each year being 100 per cent.

In order that the percentages in this chart may not be mistaken for actual quantities, the averages for the six years in absolute number of tons moved in each direction are presented in Fig. 34. It will be seen immediately that the movement is decidedly unbalanced, and the lack of balance in the individual facilities is further set off by the guide lines connecting the inward and outward bars.

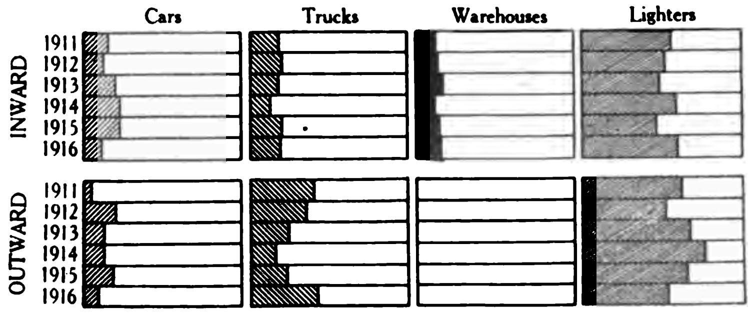


FIG. 33 — Proportion of Tonnage Moved to and from the Pier by Each of the Various Facilities

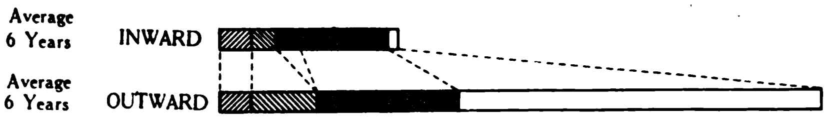


FIG. 34 — Average Amounts of Tonnage for Six Years Divided so as to Show the Proportions Handled by Each Facility.

The white portion in this diagram designates the tons moved to and from the ship by lighters offshore. Shading otherwise the same as in Fig. 33

Table 30—Detail Movement of Cargo at Pier 501 by Months for a Period of Six Years, 1911–1916 Inclusive

	Inward							Outward							Inward and outward						
1911	Cars	Trucks	Stores	Lighters	Total over pier	Over ship-side	Total	Cars	Trucks	Stores	Lighters	Total over pier	Over ship-side	Total	Cars	Trucks	Stores	Lighters	Total over pier	Over ship-side	Total
January	3,290	3,815	2,391	9,191	18,687	0	18,687	549	6,852	....	8,984	16,385	25,278	41,663	3,839	10,667	2,391	18,175	35,072	25,278	60,350
February	2,087	3,520	1,369	6,100	13,076	0	13,076	240	5,065	....	11,326	16,631	22,953	39,584	2,327	18,585	1,369	17,426	29,707	22,953	52,660
March	5,656	4,504	2,525	12,276	24,961	0	24,961	511	5,554	....	6,974	13,039	18,892	31,931	6,167	10,058	2,525	19,250	38,000	18,892	56,892
April	4,344	6,660	3,745	8,400	23,149	617	23,766	200	3,893	....	5,468	9,561	20,479	30,040	4,544	10,553	3,745	13,868	32,710	21,096	53,806
May	4,003	2,733	2,700	10,578	20,014	256	20,270	839	3,740	....	9,142	13,721	23,083	36,804	4,842	6,473	2,700	19,720	33,735	23,339	57,074
June	2,017	3,983	2,475	16,967	25,442	172	25,614	170	4,241	....	5,348	9,759	11,516	21,275	2,187	8,224	2,475	22,315	35,201	11,688	46,889
July	1,920	2,008	1,447	24,470	29,845	258	30,013	0	4,903	....	5,074	9,977	10,789	20,766	1,920	6,911	1,447	29,544	39,822	11,047	50,869
August	2,795	2,518	2,976	13,813	22,102	375	22,477	578	8,356	....	12,012	20,946	35,126	56,072	3,373	10,874	2,976	25,825	43,048	35,501	78,549
September	567	605	474	7,050	8,696	0	8,696	721	5,676	....	9,240	15,637	28,916	44,553	1,288	6,281	474	16,290	24,333	28,916	53,249
October	1,071	1,787	522	1,918	5,298	0	5,298	1,869	12,512	....	16,773	31,154	26,042	57,196	2,940	14,299	522	18,691	36,452	26,042	62,494
November	5,858	5,310	3,770	12,138	27,076	230	27,306	232	5,160	....	10,876	16,268	24,821	41,089	6,090	10,470	3,270	23,014	43,344	25,051	68,395
December	1,744	3,176	1,927	6,120	12,967	0	12,967	201	5,489	....	11,796	17,486	39,441	56,927	1,945	8,665	1,927	17,916	30,453	39,441	69,894
Total	35,352	40,619	26,321	129,021	231,313	1,908	233,221	6,110	71,441	....	113,013	190,564	287,336	477,900	41,462	112,060	26,321	242,034	421,877	289,244	711,121
1912																					
January	1,498	1,934	1,071	4,918	9,421	0	9,421	1,646	5,595	....	9,906	17,147	11,103	28,250	3,144	7,529	1,071	14,824	26,568	11,103	37,671
February	3,240	3,897	2,871	7,818	17,826	0	17,826	9,865	9,574	....	14,680	34,119	29,175	63,294	13,105	13,471	2,871	22,498	51,945	29,175	81,120
March	536	1,278	921	1,947	4,682	700	5,382	9,000	8,684	....	16,340	34,224	25,090	59,314	9,536	9,962	921	18,487	38,906	25,790	64,696
April	1,080	1,410	1,092	4,746	8,328	0	8,328	3,358	6,718	....	11,544	21,620	16,323	37,943	4,438	8,128	1,092	16,290	29,948	16,323	46,271
May	1,437	1,593	1,192	4,910	9,132	50	9,182	5,800	11,609	....	15,447	32,856	23,091	55,947	7,237	13,202	1,192	20,357	41,988	23,141	65,129
June	1,304	2,363	1,861	7,592	13,120	125	13,245	6,669	9,560	....	14,901	31,130	21,360	52,490	7,973	11,923	1,861	22,493	44,250	21,485	65,735
July	2,628	1,800	1,749	11,304	17,481	1,990	19,471	4,785	10,182	....	11,208	26,175	19,649	45,824	7,413	11,982	1,749	22,512	43,656	21,639	65,295
August	1,779	2,152	973	1,346	6,250	925	7,175	3,359	9,253	....	11,981	24,593	27,042	51,635	5,138	11,405	973	13,327	30,843	27,967	58,810
September	2,630	2,658	1,239	3,526	10,053	0	10,053	1,324	5,755	....	6,597	13,676	25,050	38,726	3,954	8,413	1,239	10,123	83,729	25,050	48,779
October	1,976	2,161	2,121	5,698	11,956	97	12,053	2,390	7,307	....	10,696	20,393	28,999	49,392	4,366	9,468	2,121	16,394	32,349	29,096	61,445
November	1,940	3,154	2,140	11,408	18,642	0	18,642	1,409	7,119	....	12,131	20,659	26,035	46,694	3,349	10,273	2,140	23,539	39,301	26,035	65,336
December	812	387	125	2,694	4,018	0	4,018	2,578	5,007	....	12,814	20,399	42,499	62,898	3,390	5,394	125	15,508	24,417	42,499	66,916
Total	20,860	24,787	17,355	67,907	130,909	3,887	134,796	52,183	96,363	....	148,445	296,991	295,416	592,407	73,043	121,150	17,355	216,352	427,900	299,303	727,203
1913																					
January	788	1,137	1,277	2,969	6,171	0	6,171	3,109	3,703	....	9,805	16,617	26,039	42,656	3,897	4,840	1,277	12,774	22,788	26,039	48,827
February	2,836	2,633	2,197	5,804	13,470	0	13,470	1,985	2,923	....	8,942	13,850	27,599	41,449	4,821	5,556	2,197	14,746	27,320	27,599	54,919
March	2,291	2,271	416	5,282	10,260	4	10,264	5,993	3,184	....	10,994	20,171	29,682	49,853	8,284	5,455	416	16,276	30,431	29,686	60,117
April	3,885	2,273	2,049	4,822	13,029	0	13,029	2,307	4,650	....	12,210	19,167	31,441	50,608	6,192	6,923	2,049	17,032	32,196	31,441	63,637
May	1,845	1,647	1,873	3,158	8,523	50	8,573	2,997	6,011	....	14,849	24,757	34,372	59,129	4,842	8,558	1,873	18,207	33,280	34,422	67,702
June	4,475	3,073	4,415	8,463	20,426	670	21,096	890	2,351	....	6,385	9,626	16,238	25,864	5,365	5,424	4,415	14,848	30,052	16,908	46,960
July	2,582	2,615	3,345	7,804	16,346	50	16,396	2,936	12,028	....	28,332	43,296	45,737	89,033	5,518	14,643	3,345	36,136	59,642	45,787	105,429
August	1,287	2,311	1,730	5,034	10,362	0	10,362	1,324	5,598	....	15,768	22,690	28,620	51,310	2,611	7,909	1,730	20,802	33,052	28,620	61,672
September	1,203	1,618	1,571	4,108	8,500	225	8,725	2,039	5,472	....	14,769	22,280	22,928	45,208	3,242	7,090	1,571	18,877	30,780	23,153	53,933
October	1,823	3,185	1,999	12,298	19,305	8,631	27,936	1,490	2,924	....	12,997	17,411	28,309	45,720	3,313	6,109	1,999	25,295	36,716	36,940	73,656
November	1,363	2,386	1,255	4,797	9,801	7,322	17,123	1,541	4,224	....	19,304	25,069	28,702	53,771	2,904	6,610	1,255	24,101	34,870	36,024	70,894
December	4,860	1,605	1,492	8,098	16,055	0	16,055	2,577	5,781	....	21,098	29,456	33,851	63,307	7,437	7,386	1,492	29,196	45,511	33,851	79,362
Total	29,238	26,754	23,619	72,637	152,248	16,952	169,200	29,188	59,749	....	175,453	264,390	353,518	617,908	58,426	88,503	23,619	248,090	416,638	370,470	787,108
1914																					
January	3,679	1,486	1,060	9,656	15,881	600	16,481	2,763	2,398	....	13,549	18,710	23,682	42,392	6,442	3,884	1,060	23,205	34,591	24,282	58,873
February	6,244	1,244	1,190	10,088	18,766	350	19,116	2,744	2,254	....	18,865	23,863	23,256	47,119	8,988	3,498	1,190	28,953	42,629	23,606	66,235
March	3,667	1,378	1,045	5,507	11,597	0	11,597	3,969	3,943	....	23,659	31,571	31,691	63,262	7,636	5,321	1,045	29,166	43,168	31,691	74,859
April	2,855	2,178	2,022	11,252	18,307	663	18,970	2,658	4,009	....	21,449	28,116	26,708	54,824	5,513	6,187	2,022	32,701	46,423	27,371	73,794
May	2,931	2,594	1,726	11,447	18,698	165	18,863	3,209	3,524	....	16,068	22,801	28,506	51,307	6,140	6,118	1,726	27,515	41,499	28,671	70,170
June	3,241	1,717	970	7,460	13,388	1,076	14,464	1,974	2,508	....	10,405	14,887	18,878	33,765	5,215	4,225	970	17,865	28,275	19,954	48,229
July	2,849	2,019	1,638	5,638	12,144	850	12,994	5,256	5,033	....	20,011	30,300	35,466	65,766	8,105	7,052	1,638	25,649	42,444	36,316	78,760
August	2,440	1,375	1,276	4,309	9,400	4,062	13,462	113	273	....	1,724	2,110	5,131	7,241	2,553	1,648	1,276	6,033	11,510	9,193	20,703
September	727	1,303	1,294	5,536	8,860	1,537	10,397	123	613	....	3,180	3,916	11,208	15,124	850	1,916	1,294	8,716	12,776	12,745	25,521
October	1,991	2,186	2,410	12,188	18,775	1,405	20,180	270	2,544	....	11,095	13,909	50,785	64,694	2,261	4,730	2,410	23,283	32,684	52,190	84,874
November	2,883	1,329	1,840	12,332	18,384	0	18,384	490	2,327	....	16,282	19,099	56,362	75,461	3,373	3,656	1,840	28,614	37,483	56,362	93,845
December	909	1,143	1,423	2,734	6,209	0	6,209	649	2,389	....	7,226	10,264	25,206	35,470	1,558	3,532	1,423	9,960	16,473	25,206	41,679
Total	34,416	19,952	17,894	98,147	170,409	10,708	181,117	24,218	31,815	....	163,513	219,546	336,879	556,425	58,634	51,767	17,894	261,060	389,955	347,587	737,542

1915																					
January	5,000	5,000	1,666	7,000	18,666	0	18,666	2,300	2,705	....	7,700	12,705	15,000	27,705	7,300	7,705	1,666	14,700	31,371	15,000	46,371
February	3,800	5,500	1,468	9,500	20,261	0	20,268	2,700	7,548	....	8,050	19,198	28,500	47,698	6,500	13,048	1,468	18,450	39,466	28,500	67,966
March	2,550	4,500	3,850	7,665	18,565	100	18,665	3,600	4,268	....	8,022	15,890	30,150	46,040	6,150	8,768	3,850	15,687	34,455	30,250	64,705
April	3,250	4,000	3,279	9,500	20,029	4,800	24,829	3,748	2,549	....	8,577	14,874	28,763	43,637	6,998	6,549	3,279	18,077	34,903	33,563	68,466
May	1,255	3,220	1,020	7,450	12,945	0	12,945	2,169	4,804	....	7,322	14,295	22,369	36,664	3,424	8,024	1,020	14,772	27,240	22,369	49,609
June	1,750	1,200	1,160	6,000	10,110	350	10,460	2,674	1,702	....	19,563	23,939	45,763	69,702	4,424	2,902	1,160	25,563	34,049	46,113	80,162
July	4,950	2,500	2,937	8,500	18,887	4,000	22,887	3,500	4,542	....	9,654	17,696	39,898	57,594	8,450	7,042	2,937	18,154	36,583	43,898	80,481
August	575	500	742	2,000	3,817	150	3,967	3,943	2,173	....	14,896	21,012	58,315	79,327	4,518	2,673	742	16,896	24,829	58,465	83,294
September	4,100	2,500	4,624	7,950	19,174	2,500	21,674	2,719	2,000	....	10,000	14,719	32,806	47,525	6,819	4,500	4,624	17,950	33,893	35,306	69,199
October	3,750	1,000	646	6,450	11,846	500	12,346	4,339	4,000	....	17,654	25,993	65,987	91,980	8,089	5,000	646	24,104	37,839	66,487	104,326
November	2,244	1,500	270	4,150	8,164	0	8,164	3,300	4,040	....	13,456	20,796	70,129	90,925	5,544	5,540	270	17,606	28,960	70,129	99,089
December	3,490	1,444	2,200	7,540	14,674	650	15,324	2,581	4,000	....	9,875	16,456	33,989	50,445	6,071	5,444	2,200	17,415	31,130	34,639	65,769
Total	36,714	32,864	23,862	83,705	177,145	13,050	190,195	37,573	44,331	....	135,669	217,573	471,669	689,242	74,287	77,195	23,862	219,374	394,718	484,719	879,437
1916																					
January	1,500	1,986	4,086	8,875	16,447	400	16,847	2,926	6,977	....	13,790	23,693	36,771	60,464	4,426	8,963	4,086	22,665	40,140	37,171	77,311
February	500	1,063	2,034	4,220	7,817	1,500	9,317	1,268	7,012	....	9,921	18,201	30,524	48,725	1,768	8,075	2,034	14,141	26,018	32,024	58,042
March	2,400	4,530	4,377	11,780	23,087	3,312	26,399	1,420	9,054	....	13,112	23,586	38,215	61,801	3,820	13,584	4,377	24,892	46,673	41,527	88,200
April	1,000	542	495	3,743	5,780	4,500	10,280	3,348	10,863	....	12,587	26,798	50,171	76,969	4,348	11,405	495	16,330	32,578	54,671	87,249
May	1,900	3,100	810	8,208	14,018	4,523	18,541	2,158	9,388	....	11,263	22,809	36,370	59,179	4,058	12,488	810	19,471	36,827	40,893	77,720
June	1,912	430	320	2,250	4,912	4,184	9,096	2,534	4,563	....	5,285	12,382	47,615	59,997	4,446	4,993	320	7,535	17,294	51,799	69,093
July	312	921	205	4,876	6,314	2,675	8,989	694	6,986	....	9,222	16,902	36,108	53,010	1,006	7,907	205	14,098	23,216	38,783	61,999
August	477	1,490	809	5,500	8,276	1,500	9,776	1,510	7,730	....	9,412	18,652	33,746	52,398	1,987	9,220	809	14,912	26,928	35,246	62,174
September	200	325	268	800	1,593	1,000	2,593	1,161	9,986	....	9,693	20,840	36,690	57,530	1,361	10,311	268	10,493	22,433	37,690	60,123
October	300	500	253	2,500	3,553	1,500	5,053	913	6,582	....	7,314	14,809	29,693	44,502	1,213	7,082	253	9,814	18,362	31,193	49,555
November	200	800	194	2,500	3,694	2,350	6,044	450	9,248	....	9,800	19,498	25,135	44,633	650	10,048	194	12,300	23,192	27,485	50,677
December	0	500	120	2,275	2,895	2,750	5,645	433	3,000	....	3,100	6,533	8,075	14,608	433	3,500	120	5,375	9,428	10,825	20,253
Total	10,701	16,187	13,971	57,527	98,386	30,194	128,580	18,815	91,389	....	114,499	224,703	409,113	633,816	29,516	107,576	13,971	172,026	323,089	439,307	762,396

By a regrouping of the figures in Tables 26, 27 and 28, we obtain Table 29, which divides the tonnage into that locally delivered via land and that locally delivered via water; in other words, that which at some time passed over the land end of the pier by car, dray or other means, and that which did not, no differentiation being made in the latter class between that transferred direct between ship and lighter and that transferred via the pier. This table, showing the preponderance of goods delivered via water, makes apparent again the error of thinking of the pier merely as a connecting link between the land and the ship, and ignoring the needs of lighter service.

It may be pointed out that goods lightered to or from the ship may also have to undergo trucking or other land movement before they reach or after they leave the lighter. Direct service is possible between the railroad and the ship through cars that run upon the pier, and between local manufacturers and the ship through trucks that load or unload at the local factory. Railroad lighterage means a rehandling at the waterfront terminal of the railroad, and lighterage of goods produced or consumed locally means a rehandling unless the factory or store be at the waterfront and accessible to lighters.

Tables 25–29 are all derived from Table 30, which gives the complete record of Pier 501, inward and outward, by months for the six years under study. Any combination of figures desired can be derived from this table, while the table reveals wide seasonal fluctuations not in any way shown by the yearly averages.

Pier Performance by Dimensional Units

Thus far the analysis of pier performance has been in such form as to bring out the tonnages, their direction and those elements in which the total may be resolved by virtue of the fact that the records themselves were so segregated. Having these elements, we can apply the four units defined on page 205 tonnages per year on the linear-foot and the square-foot bases, and on the bases of (1) merely the cargo handled *over* the pier and (2) the total cargo handled *at* the pier, including that transferred on the offshore side between ship and lighter direct.

The Commission would again warn users of these units that all of the units must be qualified by further statements as to nature and kind of tonnage. A pier which handles only one or a few commodities that are regularly shipped in uniform packages, can readily be moved by hand labor and can be tiered without machinery or tackle will show a higher performance as expressed in terms of berthing space than a pier given over to heavy machine parts or cumbersome and poorly bound bales of various and irregular sizes, or a pier specializing in seasonal commodities.

Pier 501 was thoroughly typical of general cargo of the most diverse sort, ranging from the nicely boxed products of general merchandise to iron pipe in quantity, car wheels, coffee in bags and cotton in bales; occasionally even the extra large hogsheads of loose-leaf tobacco and the awkward bundles of hides. Hence Tables 31–34, the headings of which are self-explanatory, may be regarded as characteristic for general cargo, imported as well as exported.

TABLE 31 — TONNAGES PER YEAR PER LINEAR FOOT OF BERTHING SPACE FOR GENERAL CARGO HANDLED OVER PIER 501*— FREIGHT PASSING DIRECT BETWEEN SHIP AND LIGHTER *Excluded*

YEAR	Inward	Outward	Total
1911	86.6	71.3	157.9
1912	49.0	111.1	160.1
1913	56.9	98.9	155.8
1914	63.8	82.2	146.0
1915	66.3	81.3	147.6
1916	36.8	84.1	120.9
Average	59.9	88.2	148.1
†Maximum rate	127.9	256.6	256.6
†Minimum rate	6.8	9.0	39.6

* End of pier not included as berthing space.

† Based on maximum and minimum monthly performances during the six years.

TABLE 32 — TONNAGES PER YEAR PER LINEAR FOOT OF BERTHING SPACE FOR GENERAL CARGO HANDLED FOR VESSELS BERTHING AT PIER 501*— FREIGHT PASSING DIRECT BETWEEN SHIP AND LIGHTER *Included*

YEAR	Inward	Outward	Total
1911	87.3	178.8	266.1
1912	50.4	221.7	272.1
1913	63.3	231.2	294.5
1914	67.8	208.2	276.0
1915	71.2	257.9	329.1
1916	48.2	237.2	285.3
Average	64.7	222.5	287.3
†Maximum rate	128.6	394.2	480.0
†Minimum rate	11.1	31.0	86.8

* End of pier not included as berthing space.

† Based on maximum and minimum monthly performances during the six years.

TABLE 33 — TONNAGES PER YEAR PER SQUARE FOOT OF PIER SUBSTRUCTURE AREA FOR GENERAL CARGO HANDLED OVER PIER 501*— FREIGHT PASSING DIRECT BETWEEN SHIP AND LIGHTER *Excluded*

YEAR	Inward	Outward	Total
1911	1.2	1.0	2.2
1912	0.7	1.5	2.2
1913	0.8	1.3	2.1
1914	0.9	1.1	2.0
1915	0.9	1.1	2.0
1916	0.5	1.1	1.6
Average	0.8	1.2	2.0
†Maximum rate	1.7	3.4	3.4
†Minimum rate	0.1	0.1	0.5

* Single-story pier; no deductions for aisles, columns, office space or the storing of equipment. Tonnages exclude freight passing direct between ship and lighter.

† Based on maximum and minimum monthly performances during the six years.

TABLE 34 — TONNAGES PER YEAR PER SQUARE FOOT OF PIER SUBSTRUCTURE AREA FOR GENERAL CARGO HANDLED FOR VESSELS BERTHING AT PIER 501*— FREIGHT PASSING DIRECT BETWEEN SHIP AND LIGHTER *Included*

YEAR	Inward	Outward	Total
1911	1.1	2.4	3.5
1912	0.7	2.9	3.6
1913	0.8	3.1	3.9
1914	0.9	2.8	3.7
1915	1.0	3.4	4.4
1916	0.6	3.2	3.8
Average	0.8	3.0	3.8
†Maximum rate	1.7	5.3	6.4
†Minimum rate	0.1	0.4	1.2

* End of pier not included as berthing space.

† Based on maximum and minimum monthly performances during the six years.

PIERS 601, 602 AND 603

The task of obtaining the tonnages for Piers 601, 602 and 603 was far more difficult than that of obtaining the same data for Pier 501. No records were kept of the pier performances. It was necessary to ascertain the names of all vessels docking during the period chosen for study and then go into separate records for each, obtained as inward tonnage discharged and as outward tonnage loaded. The totals for these piers have been compiled for the years 1917 and 1918 from a list of approximately 400 ships docking. While certain corrections have had to be made because of the absence of records, and certain averages weighted because of other factors, the results are thought to reflect the facts fairly accurately. They are presented in Table 35.

The figures available did not indicate how much of the tonnage was handled over the piers and how much by lighter to and from the ship direct; nor how much of that handled over the pier was handled on the second story. A rough estimate is that 10 per cent of the inward cargo at Piers 602 and 603 and 20 per cent at Pier 601 was handled on the upper floors, and that the outward percentages were probably 15 per cent at Piers 602 and 603, the upper stories being utilized under the conditions generally prevalent in 1917 and 1918 for a certain amount of short-time storage.

In order to make the data regarding Piers 601, 602 and 603 as nearly comparable as possible with those regarding Pier 501, officials of the company were asked to give their opinions as to the proportion of freight floated to and from the ships directly as compared with that handled over the pier; and to estimate the proportions that would further separate the tonnage over the pier itself into that handled by cars, trucks, warehouses and lighters. The estimates are as given in Table 36. The zeros opposite "cars" and "warehouses" are explained by the fact that at these piers, unlike Pier 501, there was no direct rail connection to the pier and there were no warehouses in the immediate vicinity. It should be emphasized here that there was no team access to the second floor of Piers 601, 602 and 603.

On the basis of the above-named estimates the totals have been divided, the results being as set forth in Tables 37 and 38, which are comparable to Tables 33

TABLE 35 — TONNAGES OF CARGO HANDLED DURING 1917 AND 1918 AT PIERS 601, 602 AND 603

PIER	Year	Inward tonnage	Outward tonnage	Total tonnage
601	1917	25,986	58,498	84,484
	1918	4,100	93,576	97,676
602	1917	32,959	479,961	512,920
	1918	20,345	241,156	261,501
603	1917	38,314	230,655	268,969
	1918	24,766	303,493	328,259

TABLE 36 — ESTIMATED PERCENTAGE OF TONNAGES OF PIERS 601, 602 AND 603 HANDLED TO AND FROM PIER IN VARIOUS WAYS

Over pier via:	Inward	Outward
Car	....	....
Trucks	15	35
Warehouses	....	....
Lighters	35	15
To vessel direct via lighter	50	50
	100	100

TABLE 37 — ESTIMATED TONNAGES PER YEAR PER LINEAR FOOT OF BERTHING SPACE FOR GENERAL CARGO HANDLED AT PIERS 601, 602 AND 603*— FREIGHT PASSING DIRECT BETWEEN SHIP AND LIGHTER AS WELL AS BETWEEN SHIP AND PIER *Included*

PIER	Year	Inward	Outward	Total
601	1917	15.7	35.5	51.2
	1918	2.5	56.7	59.2
602	1917	10.0	145.4	155.4
	1918	6.1	73.1	79.2
603	1917	11.6	69.9	81.5
	1918	7.5	92.0	99.5

* Ends of piers not included as berthing space.

TABLE 38 — ESTIMATED TONNAGES PER YEAR PER SQUARE FOOT OF PIER-FLOOR AREA FOR GENERAL CARGO HANDLED AT PIERS 601, 602 AND 603*— FREIGHT PASSING DIRECT BETWEEN SHIP AND LIGHTER AS WELL AS BETWEEN SHIP AND PIER *Included*

PIER	Year	Inward	Outward	Total
601	1917	0.6	1.4	2.0
	1918	0.1	2.3	2.4
602	1917	0.4	5.8	6.2
	1918	0.2	2.9	3.1
603	1917	0.5	2.8	3.3
	1918	0.3	3.7	4.0

* Two-story piers of which only areas of first floors were used in deriving units in table; no deductions for aisles, columns, office space or the storing of equipment.

and 34 for Pier 501. Inasmuch as it is estimated that 50 per cent of the cargo of Piers 601, 602 and 603 was handled by lighters direct (Table 36), dividing by two the figures of Tables 37 and 38 will put them on a comparable basis with Tables 31 and 33.

The three Manhattan piers moved a tonnage consisting mainly of general cargo, not so diverse in character as that on Pier 501, Brooklyn. These piers furthermore handled as a large proportion of their business the more highly fabricated articles of merchandise which in general come in cases of medium size and weight. The performances for each of the piers as measured by either the annual tonnage per linear foot of berthing space or the annual tonnage per square foot of pier-floor area are generally lower in the cases of Piers 601, 602 and 603 than those of Pier 501. The high unit of 145 tons per linear foot outward for Pier 602 is probably due to the fact that the company operating this

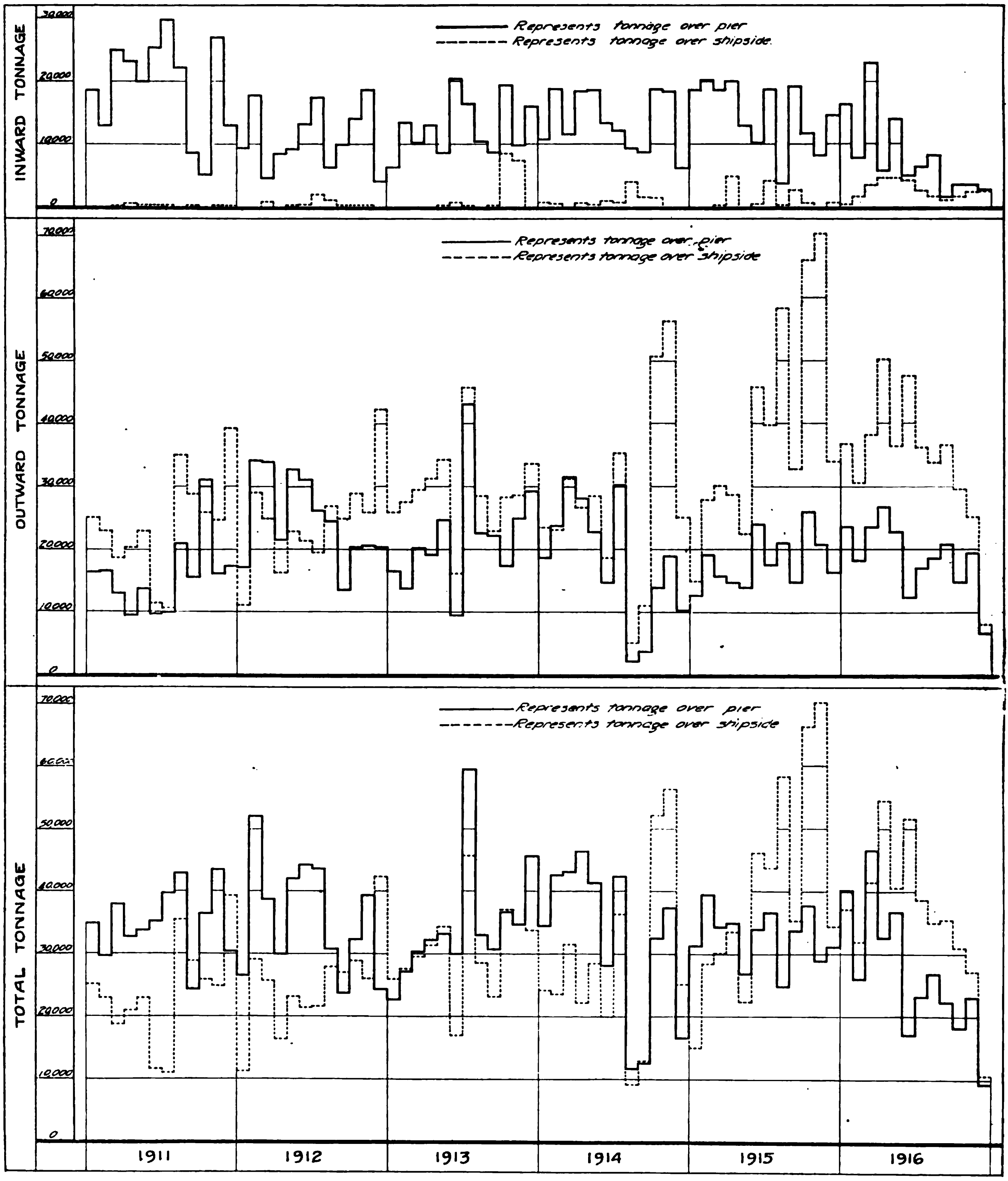


FIG. 35 — Diagram Showing the Number of Tons of 2,000 Pounds Handled Monthly at Pier 501

TABLE 33 — AVERAGE WEIGHTS AND MEASUREMENTS PER PACKAGE OF GOODS IMPORTED, AND NUMBER OF PACKAGES PER PAYABLE TON

COMMODITY	Class of package	Origin	Av. wt. per pkg., lb.	Av. meas. per pkg., cu. ft.	Number of packages per payable ton	
					wt.	meas.
Albumen	Cases	Shanghai	250	6.6	9.0	6.7
Antimony	Cases	Yokohama	240	5.0	9.4	8.0
Bagging (cotton)	Bales	Calcutta	900	26.3	2.5	1.5
Bamboo canes	Bundles	Hong Kong	250	11.0	9.0	3.7
Bamboo poles	Bales	Kobe	250	18.6	3.0	2.2
Bamboo splits	Bales	Hong Kong	130	4.6	17.0	9.0
Bamboo ware	Bundles	Kobe	150	19.6	15.0	2.0
Bean cake	Bags	Shanghai	170	3.0	13.0	13.0
Bean oil	Barrels	Hankow	450	12.0	5.0	3.3
Bean oil	Cases	Hankow	87	2.0	26.2	20.0
Bean oil	Drums	Kobe	500	11.9	4.5	3.4
Black pepper	Bags	Penang	115	6.0	13.6	8.3
Black pepper	Bags	Singapore	140	6.0	11.2	8.3
Bristles	Cases	Shanghai	100	4.6	22.0	9.0
Buffalo hides	Bales	Calcutta	1,006	35.0	1.5	1.0
Buffalo hides	Bundles	Singapore	450	10.0	3.0	5.0
Burlaps	Bales	Calcutta	1,000	25.0	1.8	1.6
Burlaps	Bales	Calcutta	1,032	25.0	1.7	1.6
Burlap cuttings	Bales	Hamburg	805	27.6	2.8	1.5
Butts (jute)	Bales	Calcutta	400	8.0	5.6	5.0
Calfskins	Bales	Calcutta	1,000	35.0	1.6	1.1
Camphor	Cases	Shanghai	125	2.9	18.0	14.5
Canes (bamboo)	Bundles	Hong Kong	250	11.0	9.0	3.7
Capsicums	Bales	Bombay	300	20.0	1.9	2.0
Cardamons	Cases	Colombo	150	4.0	15.0	12.5
Cassia	Bags	Hong Kong	140	6.9	16.0	6.0
Cassia	Bales	Hong Kong	70	5.0	32.0	8.0
Cassia	Cases	Hong Kong, Canton	77	5.6	29.0	7.3
Cassia oil	Cases	Hong Kong	80	3.0	2.8	13.3
Castor seed	Bags	Bombay	270	5.6	5.4	7.3
Chairs (rattan)	Bundles	Hong Kong	60	40.0	37.0	1.0
Chillies	Bags	Bombay	300	20.0	1.9	2.0
Chillies	Bags	Kobe	60	4.0	37.0	10.0
Chinese groceries	Misc	All ports	......	4.0	.....	10.0
Chrome ore	Mats	Kobe	159	1.9	14.0	23.0
Cigars	Cases	Manila	135	5.6	16.0	7.3
Cinnamon	Bales	Colombo	330	11.0	6.8	4.6
Cinnamon	Rolls	Colombo	100	4.6	13.4	11.0
Citronella oil	Drums	Colombo	1,400	29.0	1.1	1.4
Cloves	Bags	Penang	111	6.0	10.0	8.3
Cloves	Cases	Penang	380	16.9	6.0	3.0
Cocoanuts	Bags	Colombo	100	6.0	22.4	8.3
Cocoanut, des	Cases	Colombo	158	5.0	14.0	10.0
Cocoanut, fibre	Bales	Colombo	340	10.0	4.6	5.0
Cocoanut, fibre	Ballots	Colombo	7	0.8	224.0	75.0
Cocoanut oil	Casks	Singapore	1,200	38.0	1.9	1.3
Cocoanut oil	Pipes	Colombo	2,800	80.0	0.56	0.62
Cocoanut oil	Pynchons	Colombo	1,500	50.0	1.0	1.0
Cocoanut oil	Hogsheads	Colombo	900	35.0	1.8	1.5
Coffee	Bags	Brazil ports	132	3.0	17.0	13.0
Coffee	Bags	Singapore	133	3.0	13.5	17.0
Coir yarn	Dholls	Colombo	7	0.6	320.0	100.0
Copper	Ingots	Kobe	68	0.3	33.0	160.0
Copper ore	Bulk	Yokohama	......	......	.....	.....
Copra	Bags	Singapore	140	6.6	16.0	7.7
Copying paper	Cases	Kobe	236	12.0	9.9	3.3
Cores (rattan)	Bundles	Hong Kong	180	11.0	12.5	3.6
Cotton	Bales	Calcutta	400	12.0	5.6	3.3
Cotton	Bales	Tientsin	300	8.3	7.4	5.0
Cotton bagging	Bales	Calcutta	900	26.3	2.5	1.5
Cotton waste	Bales	Kobe	600	15.0	3.7	2.7
Cowhides	Bales	Calcutta	1,006	35.0	1.5	1.1
Cowhides	Bundles	Singapore	450	10.0	3.0	5.0
Cube gambier	Bags	Singapore	162	5.6	14.0	9.0
Curios	Cases	Chinese and Japan ports	......	15.0	.....	2.7
Cuttings (burlap)	Bales	Hamburg	805	27.6	2.8	1.5
Cuttings (hides)	Bales	Calcutta	600	22.0	2.6	1.8
Cuttings (hides)	Bales	Brazil ports	600	30.0	3.7	1.3
Cuttings (jute)	Bales	Calcutta	400	8.0	5.6	5.0
Desic. cocoanut	Cases	Colombo	158	5.0	14.0	10.0
Dogskin mats	Bales	Shanghai	940	31.0	2.4	1.3
Drums	Empty	Kobe	450	9.0	5.0	4.5
Elk hides	Bales	Singapore	300	15.0	37.0	13.0
Essential oil	Cases	Hong Kong	60	3.0	4.5	4.0
Fans	Cases	Hong Kong	125	9.9	18.0	4.1
Fans	Cases	Kobe	40	2.8	56.0	15.0
Farina	Bags	Hamburg	224	5.6	10.0	7.6
Feathers	Bales	Shanghai	......	12.0	.....	3.3
Fertilizer salts	Bags	Hamburg	204	3.9	11.0	10.7
Fibre (cocoanut)	Bales	Colombo	340	10.0	4.6	5.0
Fibre (cocoanut)	Ballots	Colombo	7	0.8	224.0	75.0
Fibre (magny)	Bales	Cebu	280	10.0	8.0	4.0
Firecrackers	Cases	Hong Kong, Canton	40	1.3	56.0	32.0
Flake (tapioca)	Bags	Singapore	180	5.0	8.7	10.0
Flour (sago)	Bags	Singapore	160	3.0	14.0	17.0
Flour (tapioca)	Bags	Singapore	200	4.0	11.2	12.5
Gall nuts	Cases	Hankow	268	10.0	8.4	4.0
Gambier	Cases	Singapore	432	8.0	5.2	6.3
Gambier (cube)	Bags	Singapore	162	5.6	14.0	9.0
Ginger	Bags	Hong Kong	110	6.0	20.0	6.7
Ginger	Casks	Hong Kong	180	6.0	12.5	6.7
Glue stock	Bales	Brasil ports	600	30.0	3.7	1.3
Glue stock	Bales	Calcutta	600	22.0	2.6	1.8
Goatskins	Bales	Hamburg	370	24.0	6.0	1.7
Goatskins	Bales	Hankow	1,000	36.0	2.2	1.1
Goatskins	Bales	Shanghai	900	33.0	2.5	1.2
Goatskins (loose)	Bales	Calcutta	650	40.0	2.4	1.0
Goatskins (comp.)	Bales	Calcutta	800	25.0	2.8	1.6
Goatskins	Casks	Calcutta	560	12.0	4.0	3.3
Graphite	Casks	Moji	320	6.6	7.0	6.0
Groceries (Chinese)	Misc	China ports	......	4.0	.....	10.0
Gum arabic	Bags	Bombay	400	8.0	4.8	5.0
Gum arabic	Bags	Sues	400	8.0	5.6	5.0
Gum copal	Baskets	Singapore	190	5.9	9.4	8.8
Gum copal	Bags	Singapore	170	6.0	11.8	8.3
Gum copal	Cases	Singapore	222	7.3	10.0	7.0
Gum damar	Bags	Singapore	170	6.0	11.8	8.3
Gum damar	Cases	Singapore	230	7.3	9.7	7.0
Gunnies	Bales	Calcutta	1,000	22.0	1.8	1.8
Gunnies	Bales	Calcutta	1,100	25.0	2.4	1.6
Gunnies	Bales	Calcutta	1,270	22.0	1.8	1.8
Gutta jelatong	Cases	Singapore	350	10.0	6.4	5.0
Gutta percha	Cases	Singapore	256	7.0	9.0	7.0
Hair (horse)	Bales	Brasil ports	800	40.0	2.8	1.0
Hair (human)	Cases	China ports	156	5.6	14.0	7.3
Hats	Cases	Manila	280	30.0	8.0	1.3
Hats (rush)	Bales	Shanghai	225	24.0	10.0	1.7
Hemp	Bales	Hamburg	460	27.0	4.9	1.5
Hemp	Bales	Calcutta	1,006	35.0	8.0	4.0
Hides (buffalo)	Bales	Singapore	450	10.0	1.5	1.1
Hides (buffalo)	Bundles	Manila	280	10.0	3.0	5.0
Hides (cow)	Bales	Calcutta	1,006	35.0	1.5	1.1
Hides (cow)	Bundles	Singapore	450	10.0	3.0	5.0
Hides (elk)	Bales	Singapore	300	15.0	4.5	4.0
Hides (cuttings)	Bales	Calcutta	600	22.0	2.6	1.8
Hide cuttings	Bales	Brasil ports	600	30.0	3.7	1.3
Horsehair	Bales	Brasil ports	800	40.0	2.8	1.0
Human hair	Cases	China ports	156	5.6	14.0	7.3
Indigo	Cases	Calcutta	400	12.0	5.6	3.3
Isinglass	Bales	Kobe	285	7.6	8.0	5.3
Jelatong	Cases	Singapore	350	10.0	6.4	5.0
Jute	Bales	Calcutta	400	8.0	5.6	5.0
Jute butts	Bales	Calcutta	400	8.0	5.6	5.0
Jute cuttings	Bales	Calcutta	400	8.0	5.6	5.0
Jute rejections	Bales	Calcutta	400	8.0	5.6	5.0
Kainit	Bags	Hamburg	204	3.9	11.0	10.7
Lac refuse	Bags	Calcutta	147	6.0	9.9	6.7
Leaves, patchull	Bales	Penang	400	20.0	2.0	2.0
Leaves, patchull	Bales	Singapore	345	20.0	2.0	2.0
Leaves, senna	Bales	Aden	400	20.0	5.6	2.0
Logs	Bulk	Calcutta	......	37.6	.....	1.1
Long pepper	Bags	Penang	140	6.0	11.2	8.3
Mace	Cases	Singapore	180	10.0	12.5	5.0
Magna fibre	Bales	Cebu	280	10.0	8.0	4.0
Manure salts	Bags	Hamburg	204	3.9	11.0	10.7
Matches (safety)	Cases	Hamburg	255	14.0	8.9	2.9
Mattings	Rolls	Hong Kong	75	4.6	29.8	9.0
Matting	Rolls	Kobe	40	3.0	56.0	13.3
Mats (dogskin)	Bales	Shanghai	940	31.0	2.4	1.3
Mica	Cases	Calcutta	130	2.3	13.8	1.8
Mustard seeds	Bags	Bombay	270	5.6	12.0	13.3
Myrabollams	Bags	Bombay	150	3.0	5.4	7.3
Myrabollams	Bags	Calcutta	56	1.1	32.0	22.2
Nutmegs	Bags	Singapore	112	3.6	14.0	14.3
Nutmegs	Cases	Singapore	80	2.6	28.0	20.0
Nut oil	Barrels	Hankow	450	12.0	5.0	3.3
Nux vomica	Bags	Calcutta	54	1.6	33.2	26.6
Oil (bean)	Barrels	Hankow	450	12.0	5.0	3.3
Oil (bean)	Cases	Hong Kong	87	2.0	26.2	20.0
Oil (bean)	Drums	Kobe	500	11.9	4.5	3.4
Oil (cassia)	Cases	Hong Kong	80	3.0	28.0	13.3
Oil (citronella)	Drums	Colombo	1,400	29.0	1.1	1.4
Oil (cocoanut)	Casks	Singapore	1,200	38.0	1.9	1.3
Oil (cocoanut)	Pipes	Colombo	2,800	80.0	0.6	0.6
Oil (cocoanut)	Pynchons	Colombo	1,500	50.0	1.0	1.0
Oil (cocoanut)	Hogsheads	Colombo	900	35.0	1.8	1.5
Oil (essential)	Cases	Hong Kong	60	3.0	37.0	13.0
Oil (nut)	Barrels	Hankow	450	12.0	5.0	3.3
Oil (palm kernel)	Casks	Hamburg	1,205	27.0	1.9	1.5
Oil (petroleum)	Casks	Hamburg	448	12.0	5.0	3.3
Oil (rose)	Pots	Bombay	190	2.0	11.6	20.0
Oil (wood)	Barrels	Hankow	700	13.0	3.2	3.0
Ore (chrome)	Mats	Kobe	159	1.9	14.0	23.0
Ore (copper)	Bulk	Yokohama	.....	......	.....	.....
Palm kernel oil	Casks	Hamburg	1,205	27.0	1.9	1.5
Paper (copying)	Cases	Kobe	236	12.0	9.9	3.3
Patchuli leaves	Bales	Penang	400	20.0	2.0	2.0
Peanuts	Bags	Yokohama	100	6.0	22.4	6.6
Pearl tapioca	Bags	Singapore	160	5.0	12.6	10.0
Peas	Bags	Hamburg	123	2.6	18.2	16.0

Table 39 — Average Weights and Measurements per Package of Goods Imported, and Number of Packages per Payable Ton

Commodity	Class of package	Origin	Av. wt. per pkg., lb.	Av. meas. per pkg., cu. ft.	Number of packages per payable ton	
					wt.	meas.
Pepper (black)	Bags	Penang	115	6.0	13.6	8.3
Pepper (black)	Bags	Singapore	140	6.0	11.2	8.3
Pepper (long)	Bags	Penang	140	6.0	11.2	8.3
Pepper (white)	Bags	Penang	180	6.0	8.7	8.3
Pepper (white)	Bags	Singapore	130	4.6	12.0	11.0
Petroleum oil	Casks	Hamburg	448	12.0	5.0	3.8
Pineapples	Cases	Singapore	80	2.6	28.0	20.0
Plumbago	Barrels	Colombo	700	13.0	3.2	3.9
Poles (bamboo)	Bales	Kobe	250	18.6	3.0	2.2
Pontianae	Cases	Singapore	350	10.0	6.4	5.0
Porcelain	Cases	Kobe	......	18.0	.....	2.2
Porcelain	Cases	Yokaichi	......	16.0	.....	2.5
Potash	Bags	Hamburg	204	3.9	11.0	10.7
Pulp	Bales	Hamburg	225	6.0	9.9	6.7
Pulp	Bales	Hamburg	285	9.0	7.9	4.4
Putch leaves	Bales	Singapore	345	20.0	2.0	2.0
Rags	Bales	Hamburg	1,140	36.0	2.0	1.1
Rattan	Bundles	Singapore	70	6.3	11.2	8.0
Rattan cores	Bundles	Hong Kong	180	11.0	12.5	3.6
Refuse (lac)	Bags	Calcutta	147	6.0	9.9	6.7
Rejections (jute)	Bales	Calcutta	400	8.0	5.6	5.0
Rice	Bags	Calcutta	224	5.0	9.0	8.0
Rose oil	Pots	Bombay	190	2.0	11.6	20.0
Rubber	Cases	Singapore	200	6.0	12.0	8.3
Rubber	Cases	Colombo	135	5.0	16.5	10.0
Rubber shoes	Bales	Hamburg	1,350	31.6	1.6	1.2
Rush hats	Bales	Shanghai	225	24.0	10.0	1.7
Safety matches	Cases	Hamburg	255	14.0	8.9	2.9
Sago flour	Bags	Singapore	160	3.0	14.0	17.0
Sake	Cases	Kobe	175	4.6	12.8	9.0
Saltpetre	Bags	Calcutta	200	3.0	11.2	13.3
Salts (fertilizer)	Bags	Hamburg	204	3.9	11.0	10.7
Salts (manure)	Bags	Hamburg	204	3.9	11.0	10.7
Seeds (castor)	Bags	Bombay	270	5.6	5.4	7.3
Seeds (mustard)	Bags	Bombay	150	3.0	12.0	13.3
Senna leaves	Bales	Aden	400	20.0	5.6	2.0
Sheep skins	Bales	Calcutta	800	25.0	2.8	1.6
Shellac	Bags	Calcutta	160	6.0	9.1	6.7
Shellac	Cases	Calcutta	200	7.0	11.2	5.7
Shoes (rubber)	Bales	Hamburg	1,350	31.6	1.6	1.2
Shoyu	Tubs	Yokohama	50	1.6	44.8	26.7
Skins (calf)	Bales	Calcutta	1,000	35.0	1.6	1.1
Skins (goat)	Bales	Hamburg	370	24.0	6.0	1.7
Skins (goat)	Bales	Hankow	1,000	36.0	2.2	1.1
Skins (goat)	Bales	Shanghai	900	33.0	2.5	1.2
Skins (goat)	Bales	Calcutta	800	25.0	2.8	1.6
Skins (goat) loose	Bales	Calcutta	650	40.0	2.4	1.0
Skins (goat)	Casks	Calcutta	560	12.0	4.0	3.3
Skins (sheep)	Bales	Calcutta	800	25.0	2.8	1.6
Soy	Kegs	Yokohama	70	1.6	32.0	26.7
Spirits	Drums	Hamburg	1,095	26.0	2.0	1.5
Splits (bamboo)	Bales	Hong Kong	130	4.6	17.0	9.0
Straw braid	Bales	Kobe	200	18.0	11.2	2.2
Straw braid	Cases	Kobe	200	30.0	11.2	1.1
Sugar	Mats	Iloilo	70	1.0	32.0	40.0
Sweepings	Bags	Colombo	81	3.3	23.5	12.3
Tallow (vegetable)	Cases	Hankow	250	4.0	9.0	10.0
Tapioca (flake)	Bags	Singapore	180	5.0	8.7	10.0
Tapioca (flour)	Bags	Singapore	200	4.0	11.2	12.5
Tapioca (pearl)	Bags	Singapore	160	5.0	12.6	10.0
Tea	Boxes	Hankow	48	2.0	40.7	20.0
Tea	Boxes	Hong Kong	48	2.0	46.7	20.0
Tea	Boxes	Keelung	45	1.6	49.8	26.7
Tea	Boxes	Kobe	48	2.3	46.7	17.8
Tea	Boxes	Shanghai	48	2.0	46.7	20.0
Tea	Boxes	Yokohama	48	2.3	46.7	17.8
Tea	Chests	Colombo	100	5.0	22.4	10.0
Tea	Chests	Fuchow	82	3.3	27.3	12.3
Tea	Chests	Hankow	82	3.3	27.3	12.3
Tea	Chests	Hong Kong	82	3.0	27.3	13.3
Tea	Chests	Kobe	94	3.9	28.0	13.3
Tea	Chests	Keelung	80	3.0	23.8	10.7
Tea	Chests	Shanghai	82	3.3	27.3	12.3
Tea	Chests	Yokohama	94	3.9	23.8	10.7
Tea sweepings	Bags	Colombo	81	3.3	23.5	12.3
Tin	Pigs	Singapore	120	0.4	18.6	120.0
Tin	Slabs	Penang	101	0.4	22.2	120.0
Toys	Cases	Kobe	......	1.6	.....	27.0
Vegetable tallow	Cases	Hankow	250	4.0	9.0	10.0
Waste (cotton)	Bales	Kobe	600	15.0	3.7	2.7
Wax	Cases	Kobe	260	5.0	8.6	8.0
White pepper	Bags	Penang	180	6.0	8.7	8.3
White pepper	Bags	Singapore	130	4.6	12.0	11.0
Wood oil	Barrels	Hankow	700	13.0	3.2	3.0
Wood pulp	Bales	Hamburg	225	6.0	9.9	6.7
Wood pulp	Bales	Hamburg	285	9.0	7.9	4.4
Wool	Bales	Shanghai	550	11.0	4.1	3.7
Wool	Bales	Tientsin	500	10.0	4.5	4.0
Wool	Bales	Tientsin	654	12.0	3.4	3.3
Yarn (coir)	Dholls	Colombo	7	0.6	320.0	100.0

pier featured outward movements at a time when phenomenal quantities of goods were moving to Europe, a zone to which this company regularly operated numerous vessels. The focusing of cargo at Pier 602 automatically lessened the unit performance of Piers 601 and 603, since the same company operated these piers as well.

Commodities and Containers

Obviously in the absence of precise data as to the total amount of cargo moved into or out of the Port of New York by ship in any given period, a classification of commodities handled similar to that presented for the railroads (Chapter 6) would have been out of the question. The Commission is able, however, to present in Table 39 a valuable record of the form, as to both weight and measurement, in which a large number of commodities are commonly shipped. The table refers to imports, is based on a company's observations over an extended period.

The Commission has on file less complete data on exports, and also data on actual dimensions of packages and containers. Because of the fragmentary nature of this information it is not presented in this report.

VI — CONCLUSION

The records of the United States Custom House, amplified to include estimates for traffic not included in those records, give a good idea of the number and sizes of ships entering New York Harbor in a given period. The estimates of the cargo they carry in and out, while less accurate, afford a fair basis for determining the accommodations in the way of piers, slips and the like required for the transfer of that cargo, when used in conjunction with the studies of the capacities of piers in terms of linear feet of berthing space, or of pier-floor area.

Light on the requirements of individual piers for different classes of service is afforded by a comparison of prevailing registered tonnages and sizes of cargo with pier capacities and rates of discharging and loading.

The data with reference to speed and cost of transferring cargo to and from ships are utilized in the study of freight-handling machinery requirements (Chapter 27). The same is true to some extent of the study of commodities and containers.

The Commission would again state that while the information presented in this chapter represents a large amount of work, with results not found by the Commission anywhere else, the study should be carried indefinitely into the future through some permanent agency. The Commission believes data of inestimable value not only to the Port of New York but to all American ports and all who have to do with their development could thus be obtained, through such a permanent agency that would be constantly collecting usable information and analyzing and making comparable current statistics of already existing agencies.

CHAPTER 8

History of the West Side Problem, and of Manhattan's Railroad Freight Problem in General

When the Hudson River Railroad was built along the West Side of Manhattan in 1847, there were no outstanding reasons why it should not be operated at grade. New York was very sparsely settled above Fourteenth Street, and for that matter railroad operation in and across streets at grade was not considered especially objectionable, as witness the large number of American cities where it was and still is permitted. In recognition of the element of danger, however, ordinary locomotives came to be prohibited south of Thirtieth Street, and the service was restricted, as at present, to special boxed-in steam locomotives operating at low speed.

Likewise from the standpoint of the efficient moving of freight, the all-rail system offered far more promise than that of the railroads west of the Hudson. When the time came to build the St. Johns Park Terminal, this plant, aided by water service to the East River, seemed to provide amply for the needs of the downtown district, while Thirty-third Street afforded room for a more extensive uptown terminal, and Sixtieth Street seemed the spot for a suburban switching yard.

Riverside Park was laid out from Seventy-second to 125th Street about 1887. The New York Central was at that time authorized to build a parapet wall along the east side of the ground it was occupying, closing nearly all of the cross streets for the extent of the park.

By this time, however, it was beginning to become evident that a change was needed, from both the public and the railroad point of view. The operation of trains in the streets was collecting an increasing human toll. The smoke, noise and odors along Riverside Park were increasing and were becoming more and more objectionable. On the other hand, the company was finding the facilities more and more inadequate for the handling of its business effectively. Public sentiment crystallized slowly, and did not become insistent for a generation. The railroad company, meanwhile, though cramped in its facilities, was yet a little better off than its New Jersey competitors, and so it did nothing. At length the public did demand a change, and in the last twelve or fifteen years the matter has been under constant agitation. The problem became known as the West Side problem, and it has remained unsolved.

That the freight operations of the New Jersey railroads on the lower West Side and throughout Manhattan, as well as those of the New York Central, are far from ideal is a very important consideration. The Commission feels that any solution of the New York Central's problem that ignored the New Jersey roads would be utterly inadequate. Partly, however, because the New York Central situation is so serious and far-reaching, and partly because the City and State have no jurisdiction over the New Jersey roads except east of the Hudson, the New Jersey roads have in the main been ignored in the public discussions. Certain unofficial organizations and individuals, unhampered by State lines, and a very few public officials more far-seeing than the others, have sought to bring the New Jersey roads directly into the problem; and the special State-appointed commission of 1917 urged the inclusion of the New Jersey roads. In the main, however, the history of the West Side problem that follows, and in fact the history of Manhattan's railroad freight problem in general, is the history of the various unsuccessful attempts to dispose of the New York Central.

SAXE LAW

As early as 1880 the public began to find the New York Central's occupancy of the city streets objectionable; in fact, unofficial proposals for something different were made before that time. It was not until 1906, however, that public agitation produced the Saxe Law, the first effort to solve the problem by legislation. This law directed the existing Board of Rapid Transit Commissioners to prepare plans and enter into an agreement with the New York Central to place the New York Central's tracks in a subway from Spuyten Duyvil south. Failing to reach an agreement in twelve months, the Board was to condemn the rights of the company to operate at grade.

No agreement was reached. In fact the chief engineer of the Commission, Mr. George S. Rice, reported adversely on the desirability of a subway for the entire distance. He recommended instead that the tracks be left on the surface north of Sixtieth Street, the streets being carried over them, except across Manhattan Valley, where the tracks were to be elevated over the streets. A tentative agreement was reached that the tracks north of Sixtieth Street should be disposed of thus, that the company should at its own expense build a subway under Eleventh Avenue from Sixtieth Street to Thirty-third Street, and that south of Thirty-third Street the problem should be given further study. It was Mr. Rice's belief, however, that further legislation would be necessary before such a plan could be adopted.

The following year the Board was replaced by the Public Service Commission for the First District, and in the course of the next two years a bill known as the Grady bill was passed, directing the New York Central to submit plans to both the Public Service Commission and the Board of Estimate and Apportionment of New York City. The bill authorized the treatment proposed by Mr. Rice north of Sixtieth Street and either an elevated line or a subway south of that point. The railroad company let it be known that it would not submit plans for a subway, and Mayor George B. McClellan, fearing heavy damage awards, it is understood, against the city if an elevated road were built, vetoed the bill.

Immediately (June 4, 1909) the Board of Estimate, acting on the advice of the corporation counsel, served notice on the railroad company to remove its tracks south of Sixtieth Street. The company brought a restraining action against the city, and on May 19, 1911, the Court of Appeals rendered an opinion to the effect that the city could not withdraw or cancel the company's franchise — that such power rested solely with the Legislature.

BOARD OF ESTIMATE GIVEN SOLE JURISDICTION

The Legislature at once enacted Chapter 777 of the Laws of 1911. This now took the matter entirely out of the hands of the Public Service Commission, and directed the company to submit to the Board of Estimate on or before October 1, 1911, plans and profiles of changes necessary to eliminate the company's occupancy at grade of public streets and places. The Board was given broad powers as to land grants or exchanges of land, but no authority to dictate any plan to the company.

OCCUPANCY OF WEST SIDE MARGINAL STREET BY RAILROAD TRACKS AND FREIGHT CARS — ONE CAUSE OF CONGESTION

MITCHEL PLAN

The company submitted its first plan September 28, 1911, calling for an elevated railroad on the Marginal Way. A committee of the Gaynor administration and later the Committee on Port and Terminal Facilities of the Board of Estimate carried on negotiations with the company and effected modifications in the plan, and in April, 1916, there was presented to the public what became known as the Mitchel plan. This contemplated about the treatment proposed in 1906 by Mr. Rice north of Sixtieth Street, but with the tracks along Riverside and other parks covered; a much expanded yard at Manhattanville, with storage tracks well out into the river; an entirely reconstructed yard at Sixtieth Street, extended some distance north under Riverside Park; a four-track elevated line on the Marginal Way to Thirtieth Street; an entirely new double-deck yard at that point, and from there south to the terminus at Canal Street a double-track elevated line on private right-of-way close to Ninth Avenue. The Board of Estimate accepted the company's claim to fully established rights all the way from Spuyten Duyvil to Canal Street, and purposed to strengthen that claim by grants of land to the company. The company agreed to spend considerable sums roofing its tracks over in Riverside Park and elsewhere.

The plan was endorsed by most of New York's newspapers, by the Chamber of Commerce, the Merchants' Association and other organizations, and by the then Commissioner of Docks. It was opposed by the West End Association and many other civic and local organizations, and early in 1917, before action had been taken by the Board of Estimate, the plan was swept aside by the passage of the Ottinger Law, which restored the jurisdiction of the Public Service Commission in the premises.

JURISDICTION OF PUBLIC SERVICE BOARD RESTORED

The Ottinger Law, Chapter 719 of the Laws of 1917, passed in May, 1917, over Mayor Mitchel's veto, stipulated that any plan adopted must be approved by the Public Service Commission for the First District, and authorized the creation of a joint conference committee of the Board of Estimate and the Public Service Commission; but it provided that unless an agreement with the company could be reached by December 1, 1917, the Commission might proceed independently of the Board of Estimate to compel the company to remove its surface tracks. It also stipulated that the company should pay rental to the city for its use of the streets, the amount of the rental to be readjusted every twenty-five years.

The company's representative asserted that this law rendered an agreement impossible, as the company "cannot and will not at any time or under any circumstances or conditions which can be proposed by anyone under the statute make or enter into any contract." The Joint Conference Committee issued "tentative proposals" and plans October 6, 1917, the main physical point of difference with the Mitchel plan being the keeping of the elevated line on the Marginal Way throughout. The other important difference was the provision for the periodical fixing of rental in accordance with the new law, and in addition the Committee introduced a proviso that after twenty-five years the city could terminate the company's entire leasehold. Taking these two main provisions together, the chance of a New York Central monopoly was eliminated. The New York Central refused, however, to consider the proposals, and the jurisdiction of the Joint Conference Committee automatically ended December 1, 1917.

Special Committee Investigates

By another Act, Chapter 720 of the Laws of 1917, a special commission, of which Mr. Wm. H. Van Benschoten was subsequently made chairman, was created to investigate the situation. This Commission, organized November 13, 1917, reported to the Governor and the Legislature January 31, 1918. The Commission condemned alike the law of 1911 giving the Board of Estimate sole jurisdiction, and the law of 1917 restoring the jurisdiction of the Public Service Commission. It urged new legislation creating a terminal commission of seven members — the Mayor and the Comptroller of New York City, ex officio, two members of the Public Service Commission, and three additional members appointed by the Governor.

This Commission was perhaps the first body created by the New York Legislature to study the problem that advocated the inclusion of the New Jersey railroads. The Commission stated that "the most important need of the City of New York is a comprehensive and modern freight terminal system, not only for the New York Central lines, but also for the railroads which float their freight across the Hudson River from the New Jersey shore." Therefore the Commission thought the terminal commission should be given power to effectuate (1) the construction of a municipal terminal by the City in agreement with the various railroads; or (2) the arrangement of a unified joint terminal system on the West Side of Manhattan by agreement with the New York Central Railroad and the other railroad and transportation companies concerned, or the construction of such terminal system by a private terminal company; or (3) compulsion, if necessary, upon the various railroads to require them to construct and operate all necessary terminal facilities, or, if such facilities shall have been constructed, to join in the use and operation of same.

The Commission was noncommittal as to whether the West Side railroad should be an elevated or subway line, but recommended a tunnel connection with New Jersey. It recommended depressing and covering the tracks along Riverside Park, and agreed with the Joint Conference Committee that the Manhattanville yard should be east of the main tracks. Additional belt lines up the East Side of Manhattan, and in fact along nearly every waterfront of the Port, were suggested.

Matter Now in Suspense

Although the Commission presented a form of law providing for a terminal commission, no legislative action has since been taken, and the problem is more or less in suspense at present. For more than two years the Board of Estimate has had under consideration a plan proposed by the Comptroller, but it is believed that this could not be carried out without further legislation.

Other Plans Proposed

While the foregoing summarizes briefly the action on the West Side problem as directed by the New York Legislature, there have been numerous other solutions advocated, by New York City officials, committees, commercial organizations and individuals. A number of these take account of the New Jersey railroads. Some of the plans are modifications of others, and only the main types need be mentioned.

In 1866 Mr. O. Vanderburgh, a civil engineer, advocating a steam passenger subway under Broadway, suggested the possible ultimate need for an elevated freight line along the Hudson River waterfront.

In 1875 a committee of the American Society of Civil Engineers created for the purpose made an extensive report on both rapid-transit and freight-terminal needs at New York. This committee recommended the construction of a double-track belt line along the waterfront, with fireproof warehouses having side-track facilities, storage space on the farms along the newly laid out West Street, and more markets. In view of this Commission's investigation of terminal costs, set forth elsewhere in this report, it is of interest that the committee stated that terminal costs ranged from $1 to $10 per ton, with an average of $3.07 per ton.

Surface Marginal Railroad

Some twenty-two years later, in 1897, a surface waterfront freight line was advocated by a board of three consulting engineers retained by the Department of Docks and Ferries. They also sought to include the New Jersey railroads. Their plan called for float bridges at Battery Park, a connection with the New York Central at Christopher Street or some point farther north, and the gradual abandonment of the pier stations as inland terminals were established. They thought it might be desirable to build an elevated passenger line on the Marginal Way, but thought freight should be handled on the surface.

Other facilities recommended by them were an East Side marginal railroad from Battery Park to Corlears Hook, and three dry docks on the West Side between Fiftieth and Fifty-second Streets, running east to Eleventh Avenue. The float bridges for the East Side marginal railroad could be at Corlears Hook. The board thought that it would be commercially desirable, but probably not feasible, to connect the two belt lines through Battery Park.

Merchants' Association Plan

In 1908 the Merchants' Association of New York issued a comprehensive report advocating a double-track freight viaduct flanked with warehouses, or a four-track freight and passenger viaduct, along the Marginal Way, the freight tracks to be used "when and so far as such use shall be found desirable or best for the public welfare." The suggestion was made that the west side of the Marginal Way, next to the bulkhead, be used for the warehouses.

The association did not undertake to say how the New Jersey railroads should be brought upon the viaduct. It gave considerable attention to passenger transit, and recommended a combination subway and elevated line in Amsterdam and Tenth Avenues and West Street as the most rapid line from upper Manhattan to the office district.

Small-Car Subway System

The same year Mr. W. J. Wilgus, representing the Amsterdam Corporation, brought forth a plan for freight subways carrying small (10-ton) cars. His plan called for a belt line and classification yard in New Jersey and a tunnel under the Hudson River. Cars would break bulk on the New Jersey side, however, their contents being transferred to or from the small cars at transfer stations at the belt-line junction points. The freight subways would run not only under the Marginal Way, but under every important street in the business section. They would be located immediately underneath the sidewalks, one track on each side of the street, where they would not interfere with passenger subways, and where they would be convenient to the basements of adjoining buildings.

The whole system would be so linked up as to provide

Interior Yard, Thirtieth Street, Manhattan — Served by Rail and by Float Bridge.

Interior Yard, Thirtieth Street, Manhattan — Section East of Eleventh Avenue — Devoted to Distribution of Milk.

great flexibility, with high-speed service on the belt line around lower Manhattan. The cars would be electrically operated and self-propelled, and though small and narrow, would run on standard-gage tracks, so that they could run or be hauled without breaking bulk to any point within the metropolitan district.

MR. TOMKINS' PLANS

As early as 1910 Mr. Calvin Tomkins, then Commissioner of Docks of New York City, was studying the situation with a view to taking care of the New Jersey railroads. In that year he issued a report recommending the construction of a four-track elevated marginal railway connecting with the New York Central, with five union terminals side by side in the blocks between Twenty-fifth and Thirtieth Streets, running east to Tenth Avenue; a sixth terminal at Canal Street; float-bridge connections for all the New Jersey roads between Thirty-seventh and Fortieth Streets, and a three-level storage and transfer yard opposite them, running to Eleventh Avenue.

The following year Mr. Tomkins presented a modification of this plan, increasing the number of float bridges to extend the entire distance between Thirtieth and Fortieth Streets, and changing the design of the terminals somewhat. In 1912 he offered still another plan, replacing the float-bridge connections by a tunnel under the North River, with a belt line and a large classification yard on the New Jersey meadows.

UNION UNIT TERMINALS

During this period Mr. Tomkins represented the minority of a commission of four appointed by the Board of Estimate to study the situation. The remaining three, consisting of Messrs. Wm. A. Prendergast, comptroller, John Purroy Mitchel, president of the Board of Aldermen, and George McAneny, president of the Borough of Manhattan, submitted a majority report advocating the removal of all longitudinal tracks south of Thirtieth Street, and the creation of what were called unit terminals inshore from existing pier stations.

The plan was to place two transfer bridges near the outshore end of the pier and utilize the pier as a means, by a switchback arrangement, of getting cars above the level of West Street and across it to a terminal on the east side of the street. Besides the ramp tracks on the piers, there would be storage and switching tracks on two levels, and it was stated that as many cars as could be placed on one track of a car float could be handled without further cutting.

CHAMBER OF COMMERCE PLAN

Late in 1911, before the Dock Commissioner's final plan calling for tunnel connections under the Hudson River for the New Jersey railroads was made public, a committee of the New York Chamber of Commerce presented a report endorsing the principle of his plan for an elevated freight railroad on the Marginal Way, and also the general features of the New York Central's proposal (its first following the passage of the law of 1911 giving the Board of Estimate jurisdiction) for such an elevated line — as far south as Cortlandt Street, or even to the Battery. The committee thought, however, that it should be built and owned by the city from Sixtieth Street south, the New York Central to lease its operating privileges and provision to be made for joint use by other railroads "should future conditions impel them to desire it." "More time and study," the committee thought, "must be given than has as yet been possible to the best method of enabling access to the proposed elevated freight structure of other roads, and more consideration given to the possibility of access in the future by freight tunnels or other methods."

Local Freight Station and Warehouse, St. Johns Park, Manhattan, Served by Rails on City's Streets

The committee elaborated on the proposal made by a committee of the Merchants' Association four years previously for warehouses on the Marginal Way. The warehouses, it was said, should be so related to the piers and the elevated railroad as to allow interchange of freight without the double cartage existing then and now. Moving platforms and elevators would be included in the equipment. It was pointed out that such warehouses would make the Marginal Way produce an income of some consequence.

STREET-LEVEL MARGINAL RAILROAD, STREET OVERHEAD

Another plan for a marginal railroad at street level was recommended in 1912 by Mr. Amos L. Schaeffer, then consulting engineer to the Borough of the Bronx. His recommendation was that an upper level of the marginal street be built over the tracks, with ramps to the side streets. He advocated an ultimate but not necessarily immediate tunnel connection with New Jersey, and thought that until such tunnel was built there should be float-bridge connections near the south as well as the north end of the marginal railroad.

SUBWAY IN MARGINAL WAY

In 1913 Mr. D. C. Willoughby submitted to the Terminal Committee of the Board of Estimate and Apportionment of New York City a plan in which the main differences from the previous plans of the Merchants' Association and the Chamber of Commerce were the substitution of a subway for an elevated line, and the use of a subsidiary subway for small cars, to assist in the distribution and assembling of small shipments. His plan contemplated a waterfront subway, tunnel connections with the New Jersey railroads, and warehouses on the Marginal Way. The main subway would have six tracks from Thirtieth Street to Cortlandt Street, with a double-track subway connection with the New York Central and two or four single-track tubes to New Jersey. The subsidiary subway would be double-track and of standard gage, but the cars would be of only 10 tons capacity, designed for rapid and flexible movement between and in terminals.

The author of the plan elaborated on the earlier proposals for warehouses on the Marginal Way. There would be seventeen such warehouses, nine stories high. Their freight handling equipment would include mechanical carriers, and elevators to carry standard cars and the smaller cars of the subsidiary subway.

SIXTEEN-TRACK SUBWAY

A sixteen-track subway under West Street and the Marginal Way was proposed in 1916 in a letter by Mr. Duncan D. McBean to the Mayor of New York City. Pairs of these tracks were to be assigned to individual railroads or groups of railroads, and to reach them there would be four double-track tunnels under the Hudson River. At various points there would be breaks in certain of the tracks sufficient to allow 1000-ft. inland platforms. Each platform would serve its own railroad or railroad group, elevators connecting the platforms with the street level.

UNION TERMINAL IN JERSEY CITY

Early in 1918 there was submitted to the Commission by Mr. George L. Record, of Jersey City, and Mr. Will H. Lyford, a Chicago engineer, a plan developed by Mr. Lyford for handling all Manhattan freight of the New Jersey railroads through a union terminal in Jersey City, the cars being turned back at that point and motor trucks carrying the freight to and from inland stations in Manhattan.

The terminal proper was to consist of a ten-story building about 4000 ft. long fronting on the north side of the Morris Canal Basin at its inner end, and sixteen parallel ells about half that length. The spaces between ells would be given over alternately to tracks and trucks, each of the New Jersey railroads having a section and reaching it via the existing inner belt line (east of the Palisades). The motor trucks would enter and leave at the north ends of the ells, being carried over the tracks, and would run to and from special floats with a capacity of forty trucks each. On the New Jersey side the landing place for the floats would be at the mouth of the Morris Canal Basin; on the Manhattan side there would be a number of landing places convenient to the inland stations. The motor trucks would have detachable bodies, so that a relatively small number of chassis could be continuously in motion while some of a larger number of bodies were being loaded or unloaded.

RAIL-WAGON SYSTEM

Another plan submitted to the Commission in 1918 was the Bonner rail-wagon plan, presented by Col. Joseph C. Bonner. Under this plan freight would be carried between the New Jersey yards and zone stations in New York in "rail wagons" — four-wheeled vehicles, designed to be hauled either by horses or by motor tractors, and with wheels at wide gage, so they could straddle special low flat cars running on an electric railway. It would be Colonel Bonner's purpose to use the Hudson & Manhattan tubes to move the rail wagons between New York and New Jersey. The wagons would be run astride the cars and jacked up so the wheels would clear.

CRAIG SUBWAY PLAN

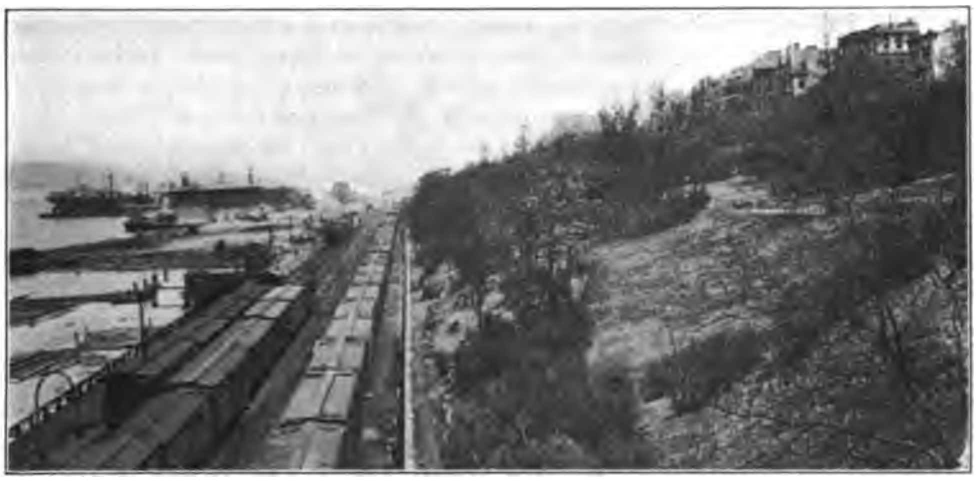
In 1918, also, Hon. Charles L. Craig, Comptroller of the City of New York, presented a report recommending the construction of a six-track subway from Fifty-ninth Street south, with union terminals, and union transfer bridges for the New Jersey railroads between Twenty-fifth and Thirtieth Streets and at Leroy and Morton Streets, the connections between the bridges and the subway to cross the Marginal Way at grade. The route he proposed for the subway was down Eleventh Avenue from Fifty-ninth to Twenty-seventh Street, thence down Tenth Avenue to Fifteenth Street, thence down Hudson Street to North Moore Street.

DOCK COMMISSIONER'S PLAN

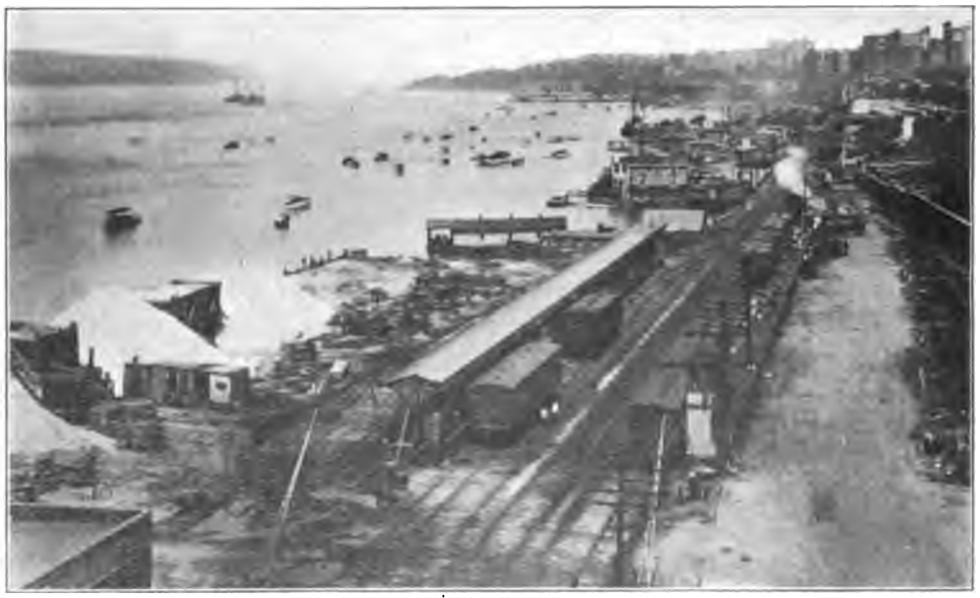
About the same time Murray Hulbert, Commissioner of Docks of the City of New York, in a statement to the Comptroller relative to the requirements of his department, reported that he had given consideration to a plan "which contemplates the removal of the New York Central Railroad from Riverside Park, and knits together more closely the commercial relations of the Boroughs of Manhattan, Brooklyn, Bronx and Queens."

Under the plan of the Commissioner of Docks, New York Central freight would follow the main passenger route from Spuyten Duyvil down the east bank of the Harlem River to a point near Mott Haven, whence a line would be built to a proposed yard in the vicinity of the East River, accessible to the New York Connecting Railroad as well as to the New York Central. From this yard would lead a subway under First Avenue, Manhattan, which would extend south to about Thirty-fourth Street. Underground laterals would cross Manhattan to the Sixtieth Street and Thirty-third Street yards of the New York Central, and a north-and-south subway would be built on the West Side south of Fifty-ninth Street. The entire West Side surface system would then be removed from Spuyten Duyvil south, with the exception of the Sixtieth and Thirty-third Street yards.

That part of the plan calling for the bringing of New York Central freight down the east bank of the Harlem River to an East River yard and the removal of the New York Central tracks in Riverside Park has been incorporated in the expanded automatic-electric system recommended by this Commission.



Westerly Border of Riverside Park, Manhattan — Railroad Tracks, Standing Cars, Contractors' Equipment and Catamarans Laden with Piles — Visualize the Park Extended to the River's Edge



Hudson River Waterfront Above 135th Street, Manhattan—Note Platform and Shed Used in the Distribution of the City's Milk Supply.

BRIDGE INSTEAD OF TUNNEL

For many years Dr. Gustav Lindenthal, consulting engineer, has advocated the building of a bridge across the Hudson River. Early in 1919 he brought forward a comprehensive plan for the solution of the railroad problem of the Port, the principal feature being the construction of a bridge instead of an uptown tunnel across the Hudson, and the inclusion of passenger traffic as well as freight traffic on the bridge. This bridge he would place in the vicinity of Fifty-seventh Street. It would be a two-level structure, New Jersey passenger trains using one level to reach a union station in the general neighborhood of the Pennsylvania Station.

Mr. Lindenthal's plan would require a belt line and classification yard (at which he would provide facilities for loading and unloading motor trucks) in New Jersey and an elevated freight line on the West Side of Manhattan, and in addition he would build a return tunnel near the Battery. Other phases of his plan are not pertinent to the Manhattan railroad problem itself. The Manhattan phases are discussed in Chapter 11.

SIX TRACK BELT LINE

Another plan brought forward again in 1919 after previous advocacy in whole or in part is that of Mr. T. Kennard Thomson, consulting engineer. This plan consists of two main propositions: (1) To extend Manhattan Island four miles southward by filling in the Upper Bay, leaving only two channels comparable to those of the present Hudson and East Rivers; (2) to encircle the island, including the extension, with a six-track surface line over which the marginal street would be carried as in the Schaeffer plan of 1912. Of the six tracks the two center ones would be main tracks, the next on either side would be switching tracks and the two outside tracks would be for loading and unloading cars. Tunnels would bring the New Jersey roads into the system, and there would be a large classification yard on the new ground considerably south of Governor's Island.

MARGINAL-WAY SUBWAY, TERMINALS ON HACKENSACK MEADOWS

A plan which, like the Lindenthal plan, reaches far beyond the West Side problem proper, was submitted to the Commission in the summer of 1919 by Mr. W. J. Bartnett. Its basic feature was a large terminal development on the Hackensack River above Secaucus — a development which would embrace railroad yards, freight sheds, warehouses and steamship piers. An auto-truck service would be established between this point and New York to help serve the metropolis, using special ferries at first, but ultimately having access to three vehicular tunnels and a bridge. There would also be a subway under the West Side Marginal Way in Manhattan from Battery Place to Seventy-ninth Street, with warehouses above it and two tunnel connections with New Jersey.

UNION TERMINAL ON JAMAICA BAY

The most recent plan brought to the Commission's attention for study was that of Mr. John H. Ward, dated September 25, 1919. It contemplated the creation of a union railroad freight terminal and wholesale market on the northwest side of Jamaica Bay. The New York Central, New Haven and Long Island railroads would reach the terminal via the New York Connecting Railroad and the Long Island itself. The New Jersey roads would reach it over the Long Island via Bay Ridge, on the Upper Bay in South Brooklyn — the present Long Island terminus of the Pennsylvania car ferry from Greenville. All other New Jersey railroads would establish similar car ferries, although a belt line just inside of the break-up yards and a tunnel under the bay are recommended. Distribution and collection of freight throughout all boroughs of New York City would be made through zone stations — three in Brooklyn and Queens, and one in the Bronx. The freight would be moved between the union terminals and the divisional stations in demounted motor-truck bodies carried on flat cars. One set of truck chassis would handle the truck bodies within the union terminal, primarily to and from stores established for the food dealers. Other chassis would take the containers at the divisional stations and deliver them within the zone to the store door, collecting other bodies.

The plan included thirteen large piers served by tracks and roadways, together with railroad yards, repair shops for cars and motor trucks, dry docks and other facilities. The principal stress was laid on the plan as an economic means for handling foodstuffs.

RELATION OF NEW JERSEY ROADS TO PROBLEM

As the foregoing shows, the West Side situation as it relates to the New York Central is acute. It is equally apparent that the agencies armed by law to effect a solution of the problem have almost wholly ignored the New Jersey railroads — contenting themselves at most with pointing out how their plans for the New York Central alone would leave the way clear for the later entry of its competitors in New Jersey. Mr. Tomkins, when dock commissioner, worked assiduously for the immediate inclusion of the New Jersey roads, and the Comptroller's plans make provision for it. But Mr. Tomkins was not clothed with the authority to accomplish what he recommended, nor has the present Comptroller sufficiently broad powers to effect a change without further legislation. The Van Benschoten commission could only recommend a program for some other body to carry out. Meanwhile the public has repeatedly demanded that something be done about the New York Central, and has made no similar demands with respect to the other railroads — paying the high cost of present methods without organized protest, if not cheerfully.

Nevertheless, many students of the problem have felt that there was something fundamentally wrong in the pier-station car-float system, and that ultimately the New Jersey roads must bring their cars to Manhattan by rail. The Commission would have been remiss in its duty if it had failed to consider this larger problem from every angle; and the solution proposed takes care of all of the railroads simultaneously.

CHAPTER 9

Elevated Standard-Equipment Railroad on the West Side of Manhattan to Accommodate the New Jersey Railroads with the New York Central

Probably nine of every ten students of the West Side problem who have considered it feasible at all to embrace the New Jersey railroads and the New York Central in one general terminal plan have pictured a marginal railroad, whether above or below ground, and whether connected with New Jersey by tunnel or bridge. Naturally, therefore, the Commission chose the marginal railroad as the starting point in its analysis. And because an elevated line would, it was thought, be less costly to construct and somewhat simpler to operate than a subway, and because there is precedent for tunnels under the Hudson River and none for a bridge, the study was directed primarily to an elevated line with tunnel connection to New Jersey. To give this plan a fair trial before condemning it as impracticable, the Commission's engineers developed the plan in considerable detail and tested its operating feasibility as well as its cost.

Its study of the problem convinced the Commission that the plan is not practicable. The largest installation that can be regarded as capable of operation as a unit, as governed both by the maximum practicable size for a joint yard and by the limit of trackage feasible in any single north-and-south thoroughfare in Manhattan, would be barely capable of handling the present tonnage with continuous 24-hour operation and would make no provision for future expansion; while the interest alone on the cost of the plant would exceed the total annual cost of the operations it would replace. The necessary capacity could be obtained by building more than one joint yard and occupying more than one longitudinal street in Manhattan, but this would in no way reduce the cost per ton for moving the freight. The unescapable conclusion is that no joint railroad for standard rolling stock will solve Manhattan's freight-distribution problem.

It was assumed that such a system would be operated by a terminal company, all railroads having equal privileges in union terminals to be distributed along the line in accordance with the total traffic. The railroads, including the New York Central, would give up their Hudson River pier stations. The New York Central would also give up its individual terminal at St. John's Park, but not that at Thirty-third Street.

The five inland terminals north of Twenty-third Street, operated respectively by the Baltimore & Ohio, Lehigh Valley, Erie, New York Central and Pennsylvania railroads, are in part team-track terminals, where the burden of the loading and unloading of freight falls upon shipper and consignee. To handle this team-track freight at the joint inland terminals would impose an extra expense upon the railroads, and it was decided to exclude the tonnage of these five terminals from that to be considered in the design of the joint terminals. The traffic of the five would be handled over the marginal railroad and delivered to the yard engines of the individual companies at the entrances to the terminals.

It was assumed that the same average loading of cars would prevail as at present, and that the large movement of empty cars, amounting to about six in every twenty in each direction and arising from the unbalanced traffic and the per diem charges on foreign cars, as explained at some length in Chapter 6, would continue. This would be the most unfavorable operating condition for the elevated system, resulting in the greatest number of cars and trains moved, and is the only safe test of the operating feasibility of the system. It was felt, too, that in the matter of costs the saving in per diem charges and in the reduction of the empty movement by any plan for breaking bulk on the New Jersey side would be largely offset by the cost of the extra handling of freight.

At the same time the Commission realized that the analysis of the joint elevated project would not be complete without a study of the possibility of reducing this excessive empty car movement. This reduction could be accomplished by the use of "trap" cars for all outbound freight except carload freight — a trap car being a car into which freight is loaded promiscuously for a short haul and redistribution to destination cars at a transfer platform. Almost any car bringing a load to a Manhattan terminal could be used for such trap-car purposes, and it would become unnecessary to bring empty cars in to be loaded. The handling operations at the terminals would also be much simpler. This use of trap cars would undoubtedly be an operating necessity, because of the difficulty of loading outbound freight for destination at the Manhattan terminals and also because of the heavy burden placed upon the entire trackage of the system if they were not used; but the saving it would effect is estimated as a bare two cents per ton, and can be ignored.

Tonnages to Be Handled

It would not be feasible to design such a system as this for a definite capacity. A minimum required capacity can be assumed and the capacity of certain parts of the system fixed accordingly, after which the remaining parts and the system as a whole can be tested against the requirements. That procedure was followed here. The number of Manhattan terminals required could be readily determined after the capacity of a single individual terminal had been analyzed, and the requirements in the way of yard facilities and main trackage could be met less precisely, but the operation of the system as a whole had then to be traced through to determine whether it could handle the traffic.

The assumed minimum capacity was the tonnage the system would have been called upon to handle in 1914, as it was apparent at the outset that a single development large enough to meet future needs would be unwieldly to operate and would exceed the capacity of any one longitudinal thoroughfare in Manhattan. Tables 11 and 12, Chapter 6, show these tonnages, together with the number of cars moved. For the design of the union terminals the tonnages of the pier stations south of Thirty-third Street, together with that at St. Johns Park, were considered in one group, while those of the few pier stations north of Thirty-third Street were considered separately. For testing out the line trackage and determining the train schedules the traffic of the inland terminals had also to be considered.

The accompanying Table 1, derived from Table 12 of Chapter 6, shows the tonnages and car movements in the form required for the design of the terminal system. If the system had been in existence in 1914 the terminals south of Thirty-third Street would have had to handle 2,739,369 tons inbound and 1,618,671 tons outbound, while those north of Thirty-third Street would have had 193,164 tons inbound and 143,260 tons outbound. With 300 working days per year the daily averages would have been 9,131 tons inbound and 5,396 tons outbound south of Thirty-third Street, and 644 tons inbound and 478 tons outbound north of Thirty-third Street.

PEAK LOADS

Traffic varies from day to day and from season to season. Accurate records in the possession of the Commission, covering the entire year of 1912 for one railroad, indicate that the maximum traffic in one day is 2.5 times the average daily traffic. This factor of 2.5 has been applied to the average daily figures to determine the capacity requirement of the individual terminal.

TABLE 1 — TONNAGES AND CARS HANDLED IN 1914 AT WEST SIDE PIER AND INLAND RAIL STATIONS SOUTH OF SIXTIETH STREET

	Tonnages handled			Number of cars handled					
				Inbound			Outbound		
Station or group of stations	Inbound	Outbound	Total	Loaded	Empty	Total	Loaded	Empty	Total
St. Johns park and pier stations south of 33d street	2,739,369	1,618,671	4,358,040	260,124	99,194	359,318	236,335	122,983	359,318
Pier stations north of 33d street	193,164	143,260	336,424	16,260	5,673	21,933	16,170	5,763	21,933
Inland stations:									
Twenty-fifth street	74,465	32,393	106,858	5,385	2.075	7,460	3,275	4,185	7,460
Twenty-sixth street	23,760	14,160	37,920	2,167	833	3,000	2,009	991	3,000
Twenty-eighth street	99,486	44,369	143,855	8,220	95	8,315	5,820	2,495	8,315
Thirty-third street	753,738	205,789	959,577	70,645	....	70,645	38,322	32,323	70.645
Thirty-seventh street	108,172	64,711	172,883	12,317	1,393	13,710	9,180	4,530	13.710
Total	3,992,204	2,123,353	6,115,557	375,118	109,263	484,381	311,111	173,276	484,381

Fluctuations in the daily traffic are due mainly to variations in the receipts of fruit and produce. Peaks for different products come at different seasons, consequently it is unlikely that maximum loads would come on more than half of these terminals at one time. Probably at the remaining terminals the average load would not be above normal. In that case the total load would be 1.75 times the normal total daily tonnage. The factor of 1.75 will be referred to as the diversity factor, and is the factor used in the study of line-haul and train operations.

Route in Manhattan

A glance at the general map (Fig. 4, Part IV) of the projected elevated line will show that the numerous tracks and the curved approaches to the terminals spread over virtually the whole width of Twelfth Avenue, Thirteenth Avenue, West Street and the Marginal Way. It was evident at the outset that no other longitudinal street would be wide enough for the elevated line, and the plans were worked out accordingly.

For other reasons the line, if built, would best be located on the Marginal Way. The noise of an elevated railroad would be least offensive if this wide thoroughfare were given over to transportation. The obstruction to light would be least in such a wide street. The structure would be out of the way of future additional rapid-transit subways. The location would also make it possible to run tracks on the second stories of certain piers if that was desired, although this is not contemplated in the plan developed.

The principal objection would be the necessity for placing all of the terminals on one side of the line.

There would need to be two New Jersey connections, best located at Fifty-fifth street and Battery Place respectively. The reasons therefor are discussed on page 227.

Manhattan Terminals

The system's Manhattan terminals would require sufficient driveway capacity, tailboard capacity, platform handling and storage capacity, car capacity and trackage for switching. The various capacities in each terminal ought to be co-ordinated as far as possible, and the limiting factor ascertained. Given this limiting factor, the number of terminals could be determined. Figs. 1 and 2 show two typical arrangements for such terminals.

DRIVEWAY CAPACITY

It was evident that the capacity of the driveways in the terminal, combined with the capacity of the adjoining streets in trucks and tons per hour, would be a predominating factor in the design of the terminals for the system under analysis. The driveways were designed to accommodate motor trucks with outside dimensions of 25 ft. x 8 ft. 4½ in. This width is a common width, and while there are trucks larger than 25 ft. they are hardly numerous enough to warrant recognition in the design.

It was thought that the driveways should be wide enough to permit four lines of trucks to pass trucks standing at the platform on each side. It was seen, however, that the driveways could be materially narrowed without much sacrifice of tailboard space by the

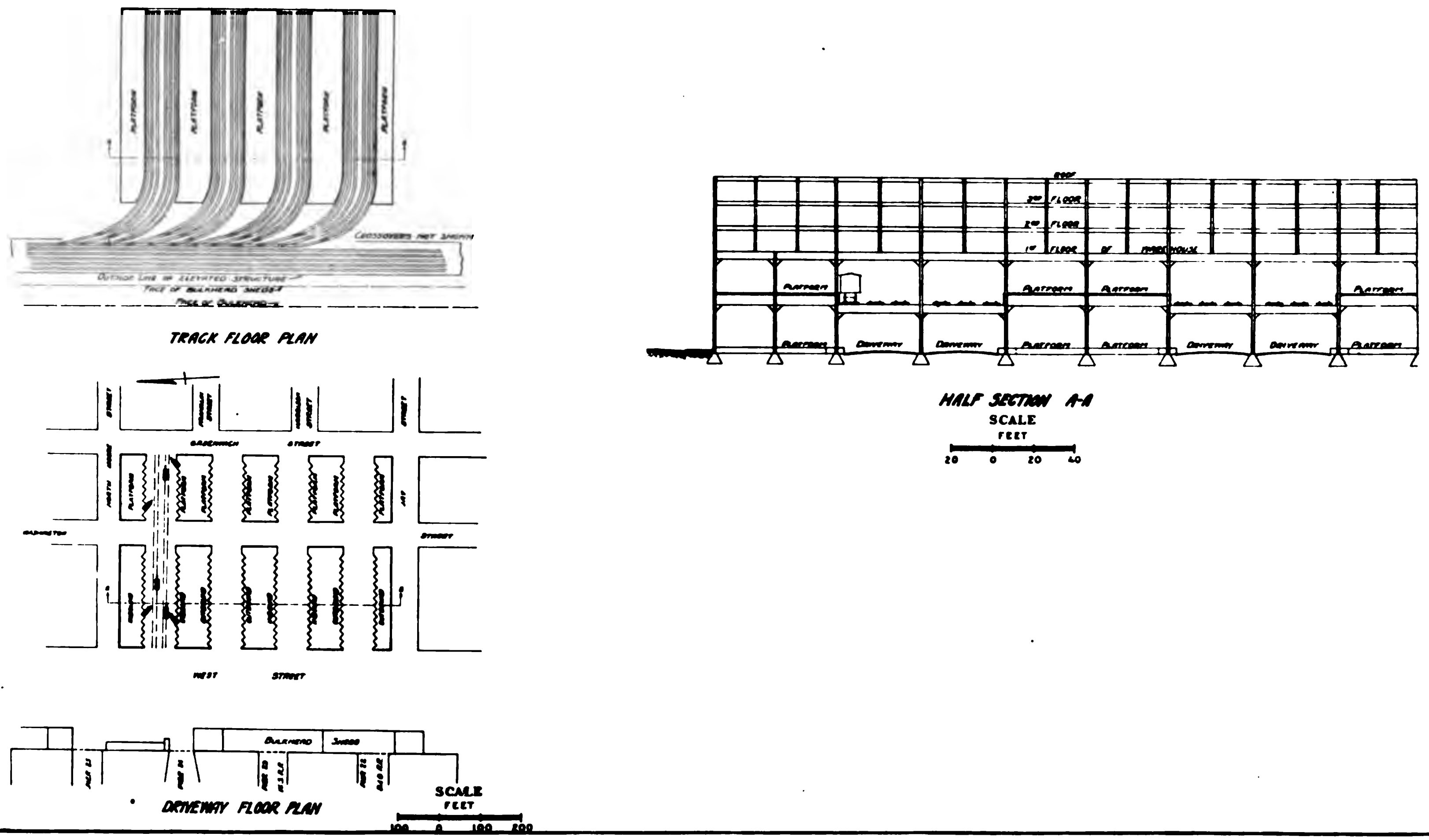


Fig. 1 — Track Floor Plan, Driveway Floor Plan and Half Section of Typical *Right-Angle* Terminal for Elevated Railroad for Standard Equipment

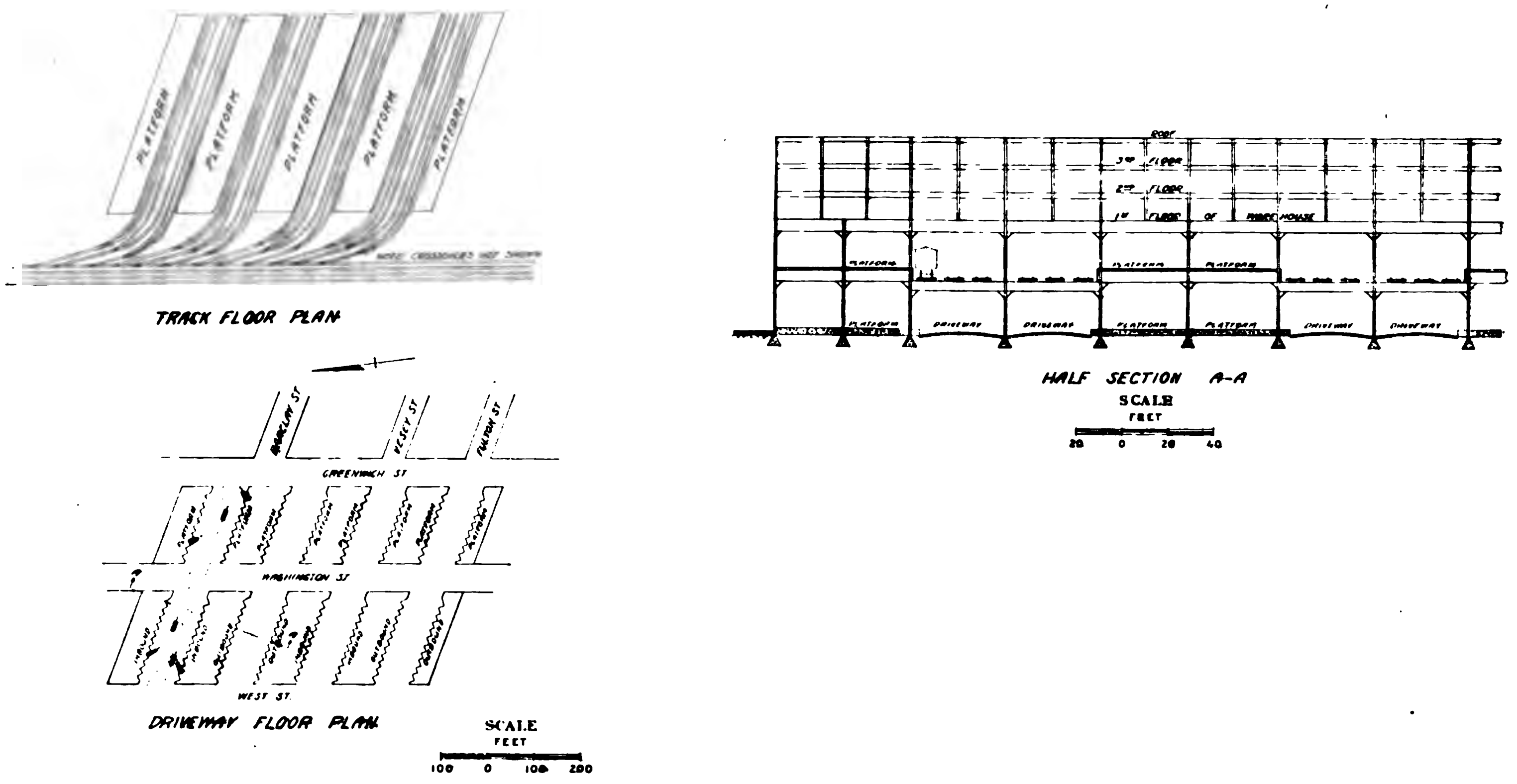


Fig. 2—Track Floor Plan, Driveway Floor Plan and Half Section of Typical *Skew* Terminal for Elevated Railroad for Standard Equipment

use of sawtooth or zigzag platforms, so that standing trucks would not project so far into the driveways. Another strong argument for the sawtooth platform is that it is almost impossible to back a large truck into a narrow berth between trucks standing at right angles to a straight platform, while the zigzag arrangement makes it much simpler.

On this basis 74 ft. was fixed as the clear width of a driveway.

With an elevated line on the Marginal Way, the terminals must necessarily be to the east of it, and in order to provide adequate switching space between terminals and keep the approach tracks in the street, stub terminals must be used, with the tracks turning off substantially parallel with the cross streets. This plan, with the terminal tracks long enough for ten cars, would carry the terminals across Washington Street to Greenwich Street, but Washington Street could be carried through breaks in the trucking platforms.

The terminals would require separate driveways for inbound and outbound traffic, all preferably fed from traffic lines on West Street and discharging on either Washington or Greenwich Street. It was soon seen that two-driveway terminals would be inadequate without an impossible number of terminals, and careful analysis was made of a four-driveway terminal, the first and third being for trucks calling for inbound freight, the second and fourth for those delivering outbound freight.

In the analysis of this hypothetical railroad it was assumed that there would be two northbound and two southbound truck lines in West Street. It was assumed also that the trucks when moving would go 3 ft. per sec., which corresponds to a speed of 2.0 miles per hour — a figure conservative when compared with those derived from extensive observations by the Commission's forces of loaded trucks under actual street conditions.

Under the conditions cited the trucks turning into any driveway from the north would bar the way to all trucks from the south, while trucks proceeding north on West Street would prevent southbound trucks from entering the driveways. These conflicting movements would greatly reduce the capacity of a single driveway. The investigation indicated that this capacity would be 60 trucks per hour. Traffic counts at the intersections of Broadway and Chambers Street, Broadway and Canal Street and various points on Washington and Greenwich Streets confirm the result of this analysis.

The clocking observations at Hudson River piers, described in Chapter 6, show that of 3000 trucks bringing freight to the piers the average load was one ton, while of 4000 trucks taking loads from the piers the average load was two tons. With these same average loads the capacity of a driveway for inbound freight would be 120 tons, while that of an outbound driveway would be 60 tons. In a 10-hour day the truck capacity for a four-driveway terminal would be 2400 tons of inbound freight and 1200 tons of outbound freight.

ARRANGEMENT AT STREET LEVEL

To serve these driveways and provide adequate space for trucks and temporary storage, and for elevating to the track level, 86 ft. over all was fixed as the width for the three interior platforms. The most northerly platform, an inbound platform, would be 63 ft. wide, while the most southerly, an outbound platform, would be 43 ft. With the driveways alternating inbound and outbound each interior platform would be half inbound and half outbound.

These widths of driveways and platforms give a total width of 660 ft., while the necessary depth to accommodate ten 42-ft. cars per track and allow trucking space past the ends of the tracks would be about 440 ft. These are the dimensions of an ideal minimum terminal. As located on the map between existing streets the dimensions of the different terminals vary; most of them are considerably larger than the minimum ideal requirement, but one or two are smaller, necessitating narrower platforms.

ARRANGEMENT AT TRACK LEVEL

The arrangement of platforms and track wells at the upper level would conform closely with that at the street level. Beginning at the north end there would be five platforms respectively 60, 80, 80, 80 and 40 ft. wide in a minimum terminal, separated by four track wells 80 ft. wide. In each track well would be six tracks on 12-ft. centers, with an extra space at the center for a row of columns.

Like the driveways, the track wells would alternate, the first and third being for inbound cars and the second and fourth for outbound cars. The two tracks on either side nearest the platforms would be loading and unloading tracks, while the remaining tracks in the center would ordinarily be used only for switching and storage.

NUMBER OF TERMINALS

The questions of tailboard capacity, of speed of trucking freight on the platform, of elevating it between the driveway and track levels, and of loading and unloading cars on this hypothetical system under analysis were carefully gone into, and the investigation confirmed the theory that the driveway capacity in trucks per hour was a major limiting factor.

On this assumption the maximum capacity of a terminal would be 2400 tons per day inbound and 1200 tons outbound. If each terminal must be capable of handling on a maximum day 2.5 times the normal day's business, the corresponding normal day's business would be 960 tons inbound and 480 tons outbound. Therefore ten terminals would be required to handle the 9131 tons of inbound freight south of Thirty-third Street.

For the ten terminals to handle the 5396 tons outbound the average load per truck would have to be increased to 1.12 tons. This would be quite possible with joint terminals, inasmuch as under present conditions many trucks deliver on one trip part loads at a number of piers, and the figure of one ton per truck is based on each individual delivery.

North of Thirty-third Street one additional terminal would take care of the present business. It is here, however, that expansion would be most likely to take place, and the plans therefore show two terminals in this district.

LOCATION OF TERMINALS

As soon as the number of terminals was fixed, lower Manhattan was divided into a corresponding number of east-and-west zones. This was done by spotting on a map the local origins and destinations of a day's traffic at all Hudson River pier stations as shown by the clocking observations, and so drawing the zone lines as to place approximately the same number of spots in each zone. The terminals were then located as nearly central as possible to their respective zones, in blocks suitable for the purpose. It was then assumed that each terminal (south of Thirty-third Street) would handle about the same tonnage, distributed in the same proportions over all of the roads.

The clockings showed that the traffic is heaviest below Canal Street. This meant narrow zones in that section — too narrow, in fact, to allow adequate spacing of the terminals. Even with several of the terminals thrown north of their ideal position there would be a bunching of them at the south end of the system.

Fig. 4, Part IV, shows the paper location of the twelve terminals for this imaginary elevated railroad. It has been assumed that the interest on the investment in terminals could be carried partly by the construction of warehouses over the tracks, as additional stories could profitably be built over the terminal property. Consequently the terminals have been designed on liberal lines, with platforms in some instances considerably longer than necessary, thus providing additional tailboard, platform and car-storage capacity at virtually no cost to the system. Three floors are as many as could well be used for warehouse purposes, inasmuch as the driveways are designed to handle only a maximum day's railroad traffic, and inasmuch as the mixing of warehouse goods with railroad freight during the handling would have to be kept down to avoid slowing up of the railroad operations.

Rail Connections

Driveway capacity, then, was a major determining factor in the design of the individual terminal, and so in the determination of the number of terminals. Given the type and capacity of the individual terminal and the number of terminals, the other main factor was the capacity of the tracks to bring the freight to and take it from the terminals. To test the feasibility of getting the required number of trains over the terminal system by a workable plan required the most careful study.

Twenty cars was assumed as the maximum length of trains to be run on the terminal system, because of the limiting grades imposed by the tunnel connections to the New Jersey railroads, and also because of the necessity for keeping the switching operations of each terminal within the short space available between terminals. The diversity factor of 1.75, and not the maximum factor of 2.5, was the one to be used in the analysis of line haul and the determination of the number of trains required. The tonnage of the individual inland terminals must be accommodated, however, as well as that of the joint terminals.

The total tonnage in 1914 for all of the terminals involved was 3,992,204 inbound and 2,123,353 outbound. This was handled in 484,381 cars each way, loaded and empty, and the same tonnages and car movements were assumed for the plan under analysis. Therefore 1615 cars must be handled on a normal day and 2826 cars, or 142 trains, on a day of maximum traffic.

TWO TUNNEL CONNECTIONS

Evidently if there were only one tunnel connection with the New Jersey railroads, traffic on the terminal system would not be uniform, but would be heaviest near the connection, trailing to nothing at the other end of the system, which would serve only one terminal. On a maximum day there would have to be at the tunnel end of the system a train on the average in each direction every ten minutes during the entire twenty-four hours of the day — a train density manifestly too great for practical operation.

The loads would be distributed more nearly uniformly by two separate tunnel connections, one near each end of the Manhattan terminal system. The line would not be operated as a loop, but each tunnel would take the trains in both directions for its own group of railroads. Near the south tunnel connection there would be a maximum number of trains of the southern group and a minimum number of the northern group. At the north end the situation would be reversed, and throughout the system the total number of trains in each direction would remain approximately constant. This is set forth clearly in the track density charts, which are described on the following page.

The southern group of railroads would comprise the Pennsylvania, Central of New Jersey, Lehigh Valley and Baltimore & Ohio. The northern group would consist of the Erie, Lackawanna, West Shore and Ontario & Western on the New Jersey side, together with the New York Central. The traffic of the southern group would be about the same as that of the New Jersey railroads of the northern group, but less than that of the entire northern group including the New York Central. The effect of this division would be to place the greatest load on that part of the system north of the Thirty-third Street terminal of the New York Central, but not make it overwhelmingly great.

MAIN TRACKS AND SCHEME OF OPERATION

Two main tracks would suffice for this hypothetical system except north of Thirty-third Street, where there must necessarily be a junction between the two New Jersey tracks and two independent tracks for the New York Central. Considering the number of switching tracks required for each terminal and the close proximity of the terminals, as well as the necessity for keeping the nearest tracks 100 ft. from the east building line of West Street and Thirteenth and Twelfth Avenues in order to avoid too sharp curves into the terminals, it would be impossible to have more main tracks without blocking the effective team access to the piers.

The most westerly track, Track A on the track chart (Fig. 5, Part IV), would carry southbound trains — incoming trains of the northern group and outgoing trains of the southern group. Track B, the other main track running the entire length of the terminal system, would be northbound, and would accommodate incoming trains of the southern group and outgoing trains of the northern group.

Line locomotives would move the cars to and from terminals, while other locomotives would do the necessary switching at terminals. A line-haul locomotive would bring a solid train to a terminal, leave it on a receiving track and pick up an outgoing train waiting at the same terminal. A switching locomotive would take the train just arrived, place its cars in proper position at the platforms of the terminal and make up an outgoing train to be ready for the arrival of the next line locomotive.

Each terminal would require three working tracks alongside the main tracks, each long enough to hold a train of twenty cars. There must be a receiving track for the incoming train, a departure track for the train ready to be removed and a runaround track for the locomotive. Because of the nearness of the terminals to each other, the three working tracks of one terminal would in some cases overlap another terminal. Hence there would be a minimum of five tracks in West Street and Thirteenth and Twelfth Avenues, six tracks at a number of points and seven for a considerable distance north of Thirty-third Street.

It would also be necessary to locate crossovers between tracks with great care, facing in such a manner that incoming trains of the northern group could run direct from Track A to the receiving track of any terminal and outgoing trains of that group could run direct upon Track B from any departure track, while trains of the southern group, whether arriving or departing, would have to make only one reverse movement.

TRACK CHART

The track chart (Fig. 5, Part IV) was developed to test the feasibility of operating the terminal system. The chart proves that it could be done, but proves also that at certain times, on a day of maximum traffic, the trains would have to run on a very short headway. It shows conclusively that the system would have to be operated continuously throughout the 24 hours of the day; that the tunnels could not accommodate the trains for an extension of the service to the East Side or to Brooklyn, and that a breakdown at one point might cause a serious derangement of the entire schedule. The 24-hour operation would have to extend to the terminals themselves and the trucking to and from them, and so would cause a radical and probably not welcome change in the methods of shippers and consignees. The alternative to this would be the surrender of revenue warehouse space to the storage of accumulated freight, and the great expense of extra handling to the different floors.

The track chart consists of four elements, all based on a day of maximum traffic:

1. A conventionalized map of the terminals, tracks and crossovers of the system in Manhattan, showing also the day's requirements of the terminals in trains.
2. A density chart for Track A, the southbound track.
3. A density chart for Track B, the northbound track.
4. A diagram representing four hours' operation of Tracks A and B from the Battery to and including the section of greatest density.

The section of greatest density lies between Thirty-ninth and Forty-third Streets, or between crossovers 49–50 and 51–52. The reason is that this section carries the entire tonnage of the northern group with the exception of the small tonnage of Terminals 11 and 12, and as previously shown the tonnage of the northern group with the New York Central's Thirty-third Street traffic exceeds the total of the southern group.

DENSITY CHARTS

In the density charts developed in the study of this imaginary railroad the bottom line is a base line, the middle line represents the trains of the northern group on that track, while the top line indicates the total of both groups. The figures below and above the middle line show respectively the number of trains of the northern and southern groups at that point.

Examining the charts, we find that in a 24-hour period 85 trains each way pass through the section of greatest density. All but eight of these in each direction would be trains of the northern group, inbound on Track A and outbound on Track B. The eight would be the trains serving Terminals 11 and 12 and the trains to and from the Pennsylvania station at Thirty-seventh Street.

Proceeding southward we find that the trains of the northern group are reduced in number as some of them are intercepted at each terminal. At the same time the number of trains of the southern group gradually increases as trains are picked up at each terminal. A marked change in the number of the northern group occurs between points 50 and 44, where the twenty trains daily of the Thirty-third Street terminal are intercepted.

From the latter point south the density of each track remains almost constant, ranging from 61 to 71 trains. The irregularities in the totals are due to the short back-up movements of trains of the southern group entering or preparing to depart from the terminals.

OPERATING SCHEDULE

If it were practicable to run all of these trains at exactly equal intervals throughout the twenty-four hours they would be 16.94 minutes apart in the section of maximum density — a satisfactory operating interval. It is not practicable to do so because of three conflicting requirements — (1) that the incoming trains be despatched at regular intervals from the yards in New Jersey and at Sixtieth Street, (2) that the feeding of cars to and withdrawal of them from the individual terminals be done at regular intervals because of the lack of storage space there, and (3) that the outgoing trains be moved at regular intervals. Conforming to the first two requirements may mean a piling up of outgoing trains because of variance in the distances covered by line locomotives serving different terminals, and in the time required to drop one train and pick up another. The practicable schedule must be a compromise between these three requirements, and the intervals between trains in this system must at certain points and times be much less than 16 minutes.

Formulas will not serve here. The schedule shown was evolved by a cut-and-try process. It is only one of many that could be worked out.

"TURNAROUND" CHARTS

In the upper right-hand corner of the track chart are what are called "turnaround" charts, one for each group — charts showing the movements, by position and by time, of a locomotive in bringing a train to a terminal and departing with another train, and showing the same with respect to the rear of the train. These charts must be taken into account in developing the train schedule, inasmuch as when a line locomotive brings a train to a terminal, uncouples and picks up another train waiting for it the way must be clear for it to depart.

In the chart for a northbound train the train is assumed to come down Track A at a speed of ten miles per hour. Arriving at the point *a*, the train begins to decelerate, coming to a standstill at the point *b*, the switch point of the crossover leading to any terminal. After waiting there one minute for a clear signal the train proceeds over the crossover to its position on the receiving track, extending from *e* to *f*.

The imaginary engine uncouples, one minute being allowed for this, and proceeds to the point *d*, where it waits one minute for the opening of the switch. It then advances to the point *k*, waits there one minute for the opening of the switch, backs to the point *e* of the forwarding track, couples up to the waiting outbound train, taking one minute for this, and proceeds from there, coming to rest at the point *d*. Here it waits again one minute for a clear signal and then proceeds on Track B.

Altogether, from the moment speed is reduced on the incoming train at the point *a* until full speed of ten miles per hour is attained by the outgoing train an interval of 24 minutes 4½ seconds elapses.

In like manner the turnaround of a train of the southern group can be traced through on the corresponding chart. This movement is more complicated and takes somewhat longer because of the fact that the incoming train must back upon the receiving track and the outgoing train must back off the departure track before proceeding southward on the main track. The locomotive, as in the other case, must run around the train it brings in to get to the opposite end of the outgoing train. The entire operation consumes 26 minutes 27½ seconds.

In the preparation of these turnaround charts it was first assumed that main-line speeds should be 10 miles and all other speeds 5 miles per hour. In order to reduce the turnaround of a train of the southern group to approximately the same length as that of a train of the northern group it was found necessary to figure switching movements of the southern group accelerating to and decelerating from 10 miles per hour.

SPACING OF TRAINS

A schedule for the despatching of trains was worked out for an entire day of twenty-four hours. The schedule shown in the lower part of the track chart covers a typical four-hour period during which one or more trains would come to virtually every joint and individual terminal.

Horizontally the graphic schedule represents distance, corresponding exactly with the charts above it. Vertically it represents time as indicated. The solid lines represent southbound trains on Track A, either inbound trains of the northern group or outbound trains of the southern group. The dotted lines indicate northbound trains on Track B — either inbound trains of the southern group or outbound trains of the northern group. The lines indicate the head ends of the trains, but there are in addition short lines showing the rear ends of the trains at the crossovers by which the trains would enter and depart from the terminals.

The turning of each incoming train into a terminal and the departure about twenty-five minutes later from the same terminal of an outgoing train hauled by the same locomotive can be readily traced out on the diagram. In the case of trains of the northern group it is shown by the groups of four short lines, each connecting three circles, lettered to correspond with the turnaround chart; in the case of the southern group it is shown by the short zigzag lines. Each of these turnaround indications is a reproduction on a small scale of part of the turnaround charts.

The general scheme of despatching is to turn the first incoming southbound train into the most northerly terminal and run each succeeding train one terminal farther, while each incoming northbound train stops one terminal short of that entered by the preceding train. The selection of terminals is such that for a good part of the four-hour period there is a gap between the trains of the northern and southern groups sufficient to avoid all fouling and overlapping movements. This gap progresses from north to south, and when the turning point of the trains of the southern group reaches the most southerly terminal it becomes necessary to run the trains of that group through to the most northerly terminals, overlapping the movements of the trains of the northern group. Thus for part of the period it is necessary to dovetail incoming trains of the northern group with outgoing trains of the southern group and outgoing trains of the northern group with incoming trains of the southern group.

Not all terminals would require the same number of trains in the 24-hour period in the operation of this hypothetical railroad. The Thirty-third Street station of the New York Central would require twenty trains daily instead of the ten or eleven required at each joint terminal south of that point. This complication is only partly met by grouping eight of the New York Central trains with the four serving the Pennsylvania's inland terminal at Thirty-seventh Street. The other inland terminals and the two joint terminals north of Thirty-third Street, on the other hand, would require fewer trains per day than the average. Consequently the progression of turnarounds at the terminals could not be regular; there must be skips at some points and extra turnarounds at others.

Even if it were possible to bring in trains of one group at absolutely regular intervals, turn them back by a regular progression from terminal to terminal and disregard the conflict with trains of the other group, the outgoing trains would be running at irregular intervals because each train would pass over a greater or less total distance than its predecessors, the difference being itself a variable quantity as between terminals.

The schedule presented represents an attempt to harmonize all of these conditions. It brings the 77 inbound trains of the northern group through the section of the greatest density at uniform intervals of 18.70 minutes throughout the twenty-four hours, alternating New Jersey and New York Central trains as far as possible so as to make the despatching intervals from the yards practically uniform. Where possible the eight trains of the southern group through the same section would be so scheduled as to make it possible for them to depart midway between the incoming trains of the northern group, making the interval between trains of the two groups 9.35 minutes; but even this would have to be reduced in one or two instances through the shifting of a train from its schedule three or four minutes to avoid conflict at some other point. On the northbound track the intervals are irregular, and in a few cases it becomes necessary to hold a train for four to six minutes to avoid conflict with some other train.

It is evident that the clearances at the crossovers are small enough to warrant the assertion that operation on a 12-hour basis is impracticable and that even on the 24-hour basis there is likely to be serious delay and congestion on days of heavy traffic. Elimination of the inbound empty car movement by the use of trap cars would help considerably, but even if the cost of the system were sufficiently low to justify it on economic grounds, the capacity would be far from satisfactory.

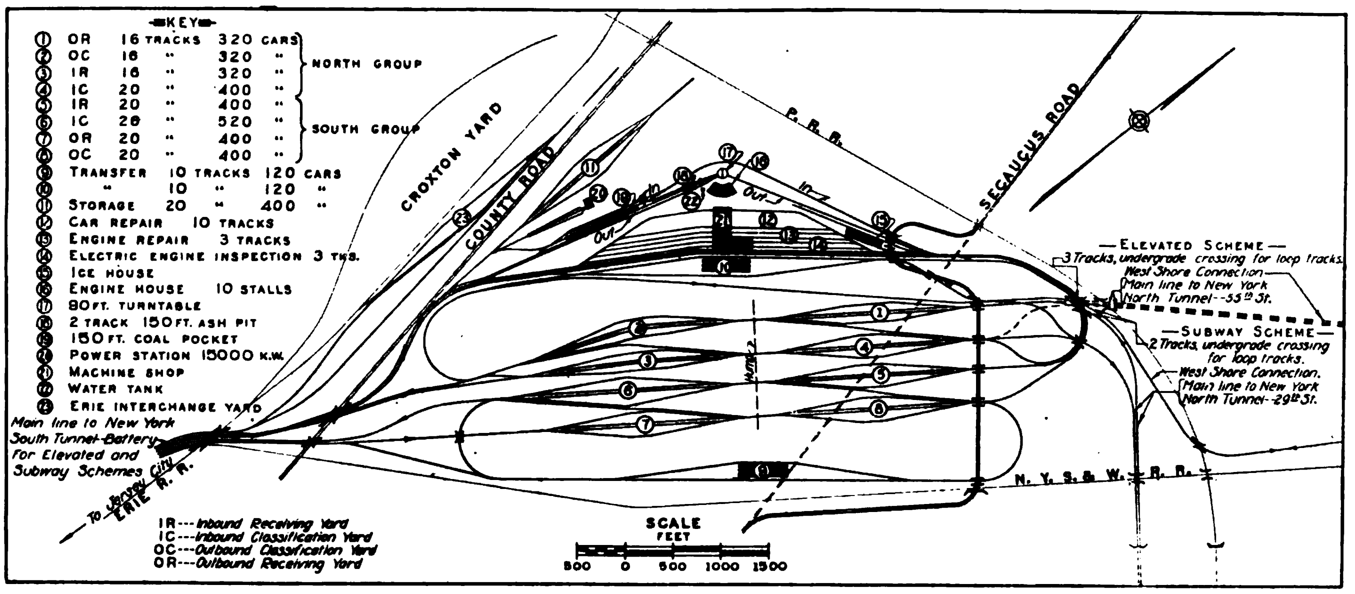


Fig. 3 — General Plan of Joint Yard in New Jersey for Either Elevated or Subway System, with Car Capacities and Other Details

Facilities in New Jersey

On the New Jersey side of the Hudson River there would be required:

1. A belt line connecting all of the New Jersey railroads;
2. Two large connected yards for handling the business of the joint Manhattan terminals;
3. Connections with the two tunnels.

USE OF EXISTING AND NEW YARDS

All inbound trains carrying Hudson River pier-station freight would pass through the existing break-up yards, where Manhattan cars would be segregated and less-than-carload freight for the West Side terminals separated from that for other local terminals. Cars would be delivered to the terminal companies at the various junctions with the belt lines, and would be classified by Manhattan stations at the new yards. Less-than-carload freight would be consolidated into cars for the different stations of the terminal system. Cars for the individual stations would then be despatched in 20-car trains as already outlined. Outbound freight would go through the same process in reverse order, except that it would move from the Manhattan terminals largely in trap cars to the joint yards.

Obviously New York Central freight would require different treatment. The railroad company would have to make up 20-car trains for single terminals at its Sixtieth Street yard, and deliver them to the terminal company.

TWO NEW YARDS

Corresponding with the two groups of railroads there would be two yards in New Jersey, connected so that either could handle an overload from the other.

Weeks of study would be required to work out the best detailed design for the new yards. The units and their sizes would have to be about as shown on the general map. They would undoubtedly be hump yards, designed for relatively short trains. Inbound classifications would be made for each of the twelve

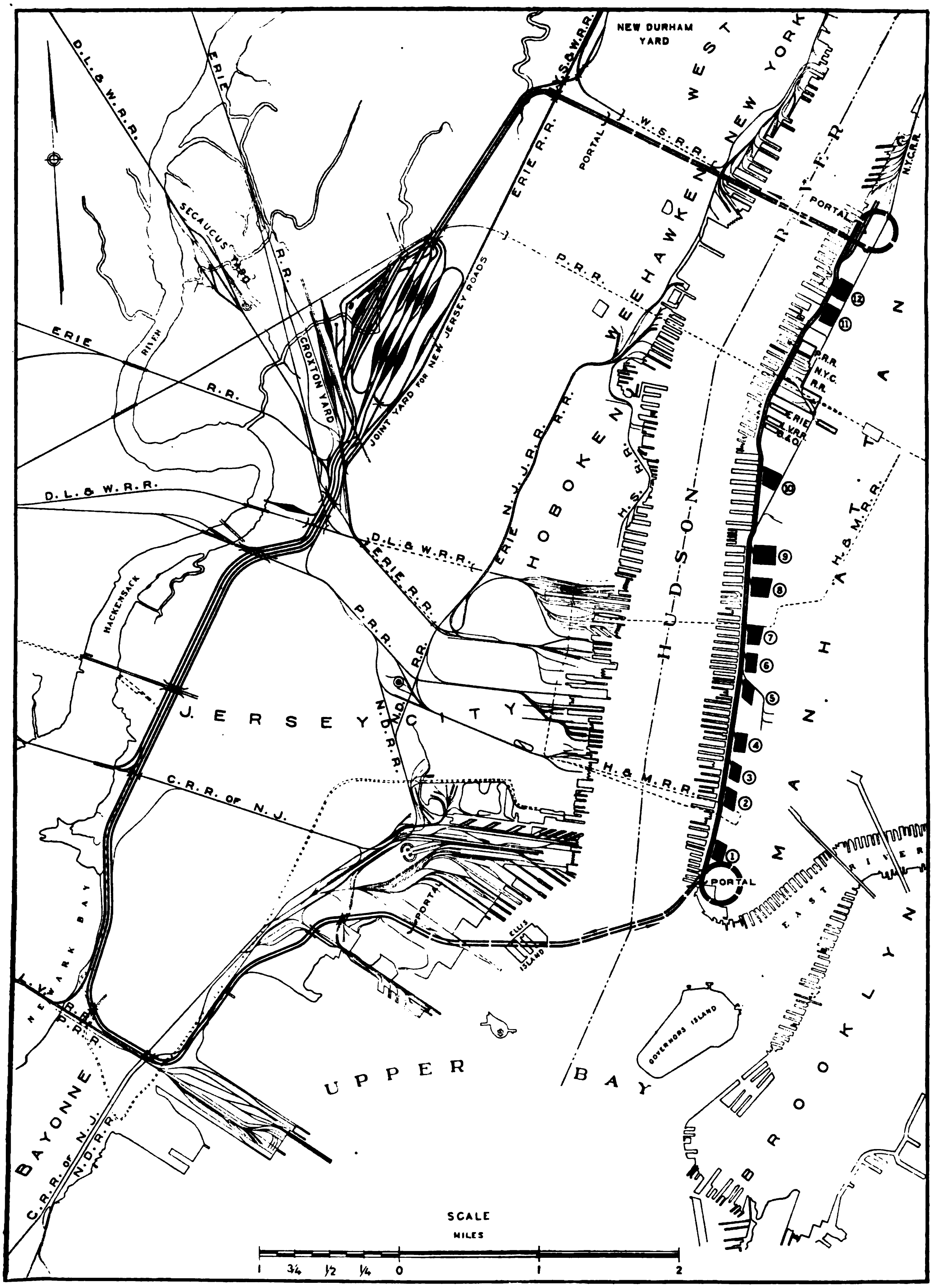


Fig. 4—General Map of Elevated Railroad System, Including New Jersey Belt Line, Joint Yard and Twelve Manhattan Terminals

Manhattan terminals; outbound only major classifications could be made for the different railroads. The transfer facilities would have to be extensive.

A possible arrangement is indicated in Fig. 3.

ROUTE OF NEW JERSEY LINES

The proposed route of the New Jersey lines and the location of the new yards are shown on the general map, Fig. 4. The route is so chosen that the belt line and the Manhattan connections would occupy the same right-of-way but with separate tracks. The Manhattan connections would be double-track throughout. The belt line would be double-track from the new yards to the crossing of the Central Railroad of New Jersey, with single-track extensions to the West Shore on the north and the Lehigh Valley on the south. In general the lines would occupy comparatively low priced land on the New Jersey meadows east of the existing break-up yards. Connection with the Central Railroad of New Jersey would be had via its Newark branch, which would also be used by the Baltimore & Ohio. The other junctions would be on the main freight lines.

The belt line must necessarily be a new line located substantially as shown.

Tunnels

For estimating purposes it was assumed that each tunnel connection would be a pair of single-track tunnels. This is the only type of tunnel that has thus far been built under the Hudson River, and so offers the best opportunity for reliable cost estimates. A double-track tunnel lined with concrete blocks might be preferable if the elevated plan were to be adopted, but the possible saving in cost would be very small compared with the total cost of the project.

In order to get the tracks of the elevated line down into the tunnels it would be necessary to build a loop as shown on the general plan at each Manhattan approach.

Power

Electric power should be used on the Manhattan lines, in the tunnels and out to the new yards, if this elevated system were to be built. Steam power would probably be used in the yards and on the belt line.

The power should be generated at 11,000 volts, alternating current, at a main power house near the new yards, and stepped down to 650 or 700 volts, direct current, at seven substations along the line in New Jersey and in Manhattan.

It is estimated that the system would require twenty-four 75-ton electric line-haul locomotives, sixteen 75-ton electric switching locomotives for the Manhattan terminals, ten steam switching locomotives for the new yards in New Jersey and twelve steam locomotives for handling the cars between the yards and the interchange points.

The number of locomotives was arrived at by careful calculations. Line-haul locomotives were figured to move at a speed of ten miles per hour for the distance traveled, and allowances were made for delays en route and for the necessary time at terminals. An analysis was also made of the work being performed by the switching locomotives, in which five miles per hour was taken as the maximum switching velocity. In all cases an allowance of 50 per cent in excess of the necessary time was made to allow for repairs and rest for the locomotives.

First Costs

Table 2 presents a summarized estimate of what the elevated system under analysis would cost to construct and equip. It shows totals of $255,009,890, $258,523,737 and $262,037,583, according as money can be borrowed at 5, 6 or 7 per cent.

This estimate, made without detail plans to work from, is based upon a careful study of the costs of as nearly similar structures as could be found, with adequate allowances to bring them up to the 1918 level of prices. Records were obtained showing the actual costs of existing yards, tunnels, subways and elevated lines in and about New York. Assessment rolls were consulted to account for the important items of real estate and right-of-way. Estimates were obtained from a reliable electric company relative to the costs of electrification and electrical equipment.

TABLE 2 — SUMMARY OF ESTIMATED COST OF JOINT ELEVATED SYSTEM

A — New Jersey Classification Yards		
Right-of-way	$150,000	
Tracks and buildings, including shops and their equipment	3,100,674	
Transfer platforms	400,000	
Bridges	276,456	
		$3,927,130
B — Belt Line in New Jersey		
Right-of-way	$703,500	
Excavation, fill and structures	4,677,740	
Tracks	910,682	
		6,291,922
C — Lackawanna and Erie Interchange Yards		
Right-of-way	$102,320	
Fill	42,400	
Tracks	266,690	
		411,410
D — Tunnels to Battery in Manhattan		
Right-of-way in New Jersey	$10,000	
Right-of-way in Manhattan	1,964,000	
Tubes and approaches	27,589,250	
Tracks	137,877	
		29,701,127
E — Tunnels to Fifty-fifth Street, Manhattan		
Right-of-way in New Jersey	$136,000	
Right-of-way in Manhattan	595,500	
River tunnel	14,665,250	
Double-track tunnel through Bergen Hill	3,779,100	
Tracks	123,912	
		19,299,762
F — Elevated Structure in Manhattan		
Real estate and easements	$1,000,000	
Elevated structure	22,881,750	
Tracks	1,088,477	
		24,970,227
G — Twelve Terminals in Manhattan		
Real estate	$38,270,700	
Terminal buildings	93,054,112	
Terminal-connection structures	10,132,800	
Tracks	891,820	
		142,349,432
H — Electrification and Signal Devices		
Power house and seven substations	$3,250,000	
Third rail and feeders	3,305,400	
Interlocking and signal devices	750,000	
		7,305,400
I — Equipment		
Steam locomotives	$550,000	
Electric locomotives	2,400,000	
Tractors	180,000	
Trailers	54,250	
		3,184,250
Total		$237,440,660
Interest during construction on above total, exclusive of equipment, based on three-year construction period:		
Interest at 5 per cent		$17,569,230
Grand total		$255,009,890
Interest at 6 per cent		$21,083,077
Grand total		$258,523,737
Interest at 7 per cent		$24,596,923
Grand total		$262,037,583

The largest item comprises the twelve terminals. As already stated, most of the terminals as shown are considerably larger than the minimum requirement. To have held them to the minimum size would have meant using fractions of city blocks, and it was deemed preferable to utilize the full area as further provision for expansion. As previously stated, the terminals are designed with three warehouse floors above the two floors required for railroad purposes. The area available for warehouse purposes in each terminal, after allowances were made for stairs, elevators, aisles and terminal offices, would, it is estimated, bring an annual rental of $3,903,733.

Operating Costs

Operating costs per engine-hour for different classes of terminal service were worked out in the analysis of operating costs under present conditions. The analysis of the operation of the hypothetical elevated system included an estimate of the number of engine-hours required. From the two sets of figures it was possible to develop estimated operating costs of the proposed system on the same basis as those derived for present operations — cost per car, per loaded car and per net ton, and the elements of those costs, by successive operations. The estimates are based upon 1918 prices and labor conditions. A careful study was also made of the probable handling costs at one of the proposed joint terminals.

Compared with the 1918 costs of operating the present facilities, these costs being $14.2193 per car delivered, $20.0736 per loaded car delivered and $2.2525 per ton delivered when 5 per cent is figured as the rate at which money can be borrowed, the operating costs of the elevated system would be $21.9439 per car, $30.9786 per loaded car and $3.4761 per ton. In other words, the contemplated system with the 1914 tonnages would be fully 50 per cent more expensive to operate than the present facilities.

ELEMENTS OF COST

Table 3 shows the operating costs per car of the elevated system, separated by successive operations and also divided between direct costs and fixed charges.

TABLE 3 — ELEMENTS BY SUCCESSIVE OPERATIONS ENTERING INTO AVERAGE COST PER CAR AT 1918 PRICES TO OPERATE JOINT ELEVATED RAILROAD SYSTEM ON WEST SIDE — FROM BREAK-UP YARDS TO TAILBOARD

	Direct costs	Fixed charges	Total
Classification and switching at break-up yards.	$ .8852	$ .1025	$ .9877
Line haul, break-up yards to joint terminal yards	.4416	.3712	.8128
Classification and switching at joint yards......	.8558	.3805	1.2363
Transfer-platform operations at joint yards....	4.2749	.5856	4.8605
Line haul, joint yards to Manhattan terminals..	.6694	3.9884	4.6578
Switching at Manhattan terminals............	.8129	2.2812	3.0941
Handling freight at terminal stations..........	3.7299	7.7828	11.5127
Total, all operations.....................	$11.6697	$15.4922	$27.1619
Average total per car delivered...........	7.2216	14.7223	21.9439

Table 4, reproduced from Table 18 of Chapter 6 for convenience of comparison, shows in similar detail the costs per car of present operations. Table 5 in like manner covers the operating costs per ton of the elevated system, amplified to embrace three rates of interest for borrowed money, and Table 6, similarly amplified from Table 19 of Chapter 6, affords a direct comparison with present methods of the per-ton basis. It is explained in Chapter 6 that these elements produce higher totals than the actual averages of the preceding paragraph for the reason that they assume that every car and every ton would go through every operation, whereas that would not be the case.

TABLE 4 — ELEMENTS BY SUCCESSIVE OPERATIONS ENTERING INTO AVERAGE COSTS PER CAR AT 1918 PRICES TO OPERATE PRESENT HUDSON RIVER PIER AND INLAND RAIL STATIONS (TABLE 18, CHAPTER 6, REPRODUCED)

	Direct costs	Fixed charges	Total
Classification at break-up yards................	$ .8942	$ .2197	$1.1193
Breaking bulk at transfer stations............	4.2416	.0498	4.2914
Line haul between yards and terminals........	.6582	.3145	.9727
Switching and bridging at waterfront..........	1.6054	.9758	2.5812
Car-float operations........................	2.0691	.3159	2.3850
Handling freight at terminal stations..........	5.9441	2.3295	8.2736
Total, all operations.....................	$15.4126	$4.2052	$19.6178
Average total per car delivered..........	10.3281	3.8912	14.2193

The itemized figures are not all comparable, because the contemplated scheme eliminates the present marine operations, adds a classification yard and also adds a stretch of line haul between the present break-up yards and the new joint yards. The accounting headings are identical and the operating stages are nearly enough alike to show that the disadvantage of the proposed plan is due solely to the heavy overhead charges, particularly the interest on the $250,000,000 investment. The traffic such an elevated system could handle would be entirely insufficient to absorb the interest burden. The higher the interest rate the greater would be the disadvantage of the elevated system.

Classification and switching at the existing break-up yards would be somewhat cheaper than it is at present for the reason that all tonnage for the West Side stations would pass through the break-up yards and take its share of the overhead expense, whereas at present much of it goes direct to the waterfront yards.

Operation of the new joint yards would be no cheaper than that of the existing yards, except in the matter of maintenance of way, because of the smaller train units and greater complexity of the operations of the new yards. These operations would also carry a heavy burden of overhead. Virtually the same thing can be said of the transfer-platform operations in the new yards.

In the matter of line haul, also, the direct operating charges against the two stretches would be more ex-

TABLE 5 — ELEMENTS ENTERING INTO AVERAGE COST PER TON AT 1918 PRICES TO OPERATE JOINT ELEVATED RAILROAD SYSTEM ON WEST SIDE—FROM BREAK-UP YARDS TO TAILBOARD

		Interest rate 5 per cent		Interest rate 6 per cent		Interest rate 7 per cent	
	Direct costs (a)	Fixed charges (b)	Total costs $(c = a + b)$	Fixed charges (d)	Total costs $(e = a + d)$	Fixed charges (f)	Total costs $(g = a + f)$
Classification and switching at break-up yards........................	$ .1403	$ .0162	$ .1565	$ .0185	$ .1588	$ .0211	$ .1614
Line haul, break-up yards to joint terminal yards.....................	.0693	.0583	.1276	.0675	.1368	.0770	.1463
Classification and switching at joint yards..........................	.1343	.0598	.1941	.0692	.2035	.0780	.2123
Transfer-platform operations at joint yards.........................	.6720	.0920	.7640	.1248	.7968	.1407	.8127
Line haul, joint yards to Manhattan terminals......................	.1060	.6318	.7378	.7317	.8377	.8341	.9401
Switching at Manhattan terminals....................................	.1287	.3614	.4901	.4117	.5404	.4621	.5908
Handling freight at terminal stations...............................	.5908	1.2329	1.8237	1.4946	2.0854	1.7563	2.3471
Total, all operations...	$1.8414	$2.4524	$4.2938	$2.9180	$4.7594	$3.3693	$5.2107
Average total per ton delivered..................................	1.1439	2.3322	3.4761	2.7517	3.8956	3.1712	4.3151

pensive than the single stretch under existing conditions, and the line haul between the joint yards and the Manhattan stations would have to carry the heavy interest charges on the tunnels.

A distinct advantage to the elevated system, and virtually the first important advantage encountered, would be the direct charges against switching operations at the Manhattan terminals. These can be compared with the costly switching and bridging operations at the present waterfront yards, and are shown to be only half as expensive. The advantage, however, is swept away when the overhead charges of the elevated structure are taken into account.

The final item, handling freight at terminal stations, gives the proposed plan another decided advantage when only direct operating costs are taken into account. This would necessarily be so, because one of the major purposes of the elevated system would be to substitute for the pier stations with all their inherent disadvantages modern terminals with ample driveways, ample platform space and ample opportunity for the prompt loading and unloading of cars. But here again when the interest on the investment is added the cost per ton is 51 cents more than at the existing pier and inland stations, despite the fact that a credit of 64 cents per ton would be derived from the rentals of the three upper floors of the terminals for warehouse purposes.

TABLE 6 — ELEMENTS ENTERING INTO AVERAGE COST PER TON AT 1918 PRICES TO OPERATE HUDSON RIVER AND INLAND RAIL STATIONS (TABLE 19, CHAPTER 6, AMPLIFIED)

		Interest Rate 5 Per Cent		Interest Rate 6 Per Cent		Interest Rate 7 Per Cent	
	Direct costs (a)	Fixed charges (b)	Total costs (c = a + b)	Fixed charges (d)	Total costs (e = a + d)	Fixed charges (f)	Total costs (g = a + f)
Classification at break-up yard	$ .1364	$ .0335	$ .1699	$ .0379	$ .1743	$ .0423	$ .1787
Breaking bulk at transfer stations	.6667	.0078	.6745	.0089	.6756	.0099	.6766
Line haul between yards and terminals	.1024	.0490	.1514	.0548	.1572	.0606	.1630
Switching and bridging at waterfront	.2528	.1537	.4065	.1696	.4224	.1855	.4383
Car-float operations	.3280	.0500	.3780	.0567	.3847	.0634	.3914
Handling freight at terminal stations	.9416	.3690	1.3106	.3775	1.3191	.3860	1.3276
Total all operations	$2.4279	$ .6630	$3.0909	$ .7054	$3.1333	$ .7477	$3.1756
Average total per ton delivered	1.6361	.6164	2.2525	.6529	2.2890	.6894	2.3255

In short, the imposing of an extra burden of $1.79 in interest and other overhead charges against each ton of freight passing through every operation would effect a saving of only 59 cents per ton in the sum of the direct operating costs; or if we take into account the fact that not all of the freight undergoes every operation and consider the average cost per ton delivered, we have $2.34 overhead and $1.14 direct charge against the elevated system as compared with 62 cents overhead ond $1.63 direct charge, and to save 49 cents direct we impose an indirect burden of $1.72.

The saving in marine operations would not justify the cost of the tunnels which would replace them, and the saving at the pier stations would not justify the large terminals to replace them. The other parts of the contemplated system — the new yards, the belt line and the connections with the individual railroads — would be sheer additions to existing facilities, and not substitutions for anything.

Conclusion

The first cost of an elevated system at 1914 prices would possibly have been 40 per cent less than at 1918 prices, and if the system could be built under such prices the interest burden would be less overwhelming. The saving with respect to direct charges would be somewhat less than under the higher 1918 prices for labor. The sum of the direct and indirect charges under those conditions might not be much if any more per ton than that shown for the existing facilities. Rough calculations made show that it would not be less, and inasmuch as the Commission sees no reason to hope for a return of prices to the level of 1914, it was deemed futile to go more fully into what might have been accomplished then.

If the tonnage under consideration were to double in the course of the next decade or two, and it were possible to utilize the system contemplated, only adding new terminals to take care of the additional business, the tonnage would still fail to carry the interest charges and justify the system. The twelve terminals in the plan presented involve 60 per cent of the first cost. One of the terminals north of Thirty-third Street would not be strictly essential to the handling of present business, and twenty terminals would possibly suffice for a tonnage of 12,000,000 tons per year. The eight additional terminals would add at least $100,000,000 to the cost of the project, making no allowance for further rises in construction costs; the net reduction in the overhead charge per ton would not be more than 60 or 75 cents, and the cost per net ton delivered would still be upward of $2.70 as compared with $2.25 with the present facilities.

On the other hand, the crowded operating schedule developed to take care of the present 6,000,000 tons per year with an elevated system is conclusive evidence that the tunnels and main tracks could not accommodate 12,000,000 tons. To handle the additional tonnage the entire system would have to be virtually duplicated, and the case for the elevated system would be no stronger than at present.

The only conclusions that can be drawn are that whatever tonnages are considered, whether at present existent or expected in the future, with any scale of prices that can safely be used, an elevated marginal railroad to serve all of the West Side railroads and operate under the conditions here set forth cannot be justified.

CHAPTER 10

Underground Standard-Equipment Railroad on the West Side of Manhattan

Advocates of a joint railroad for standard equipment on the West Side of Manhattan have been divided in their views as to whether it should be elevated or underground. The impracticability of an elevated line is set forth in Chapter 9. Equal care has been exercised in the study of an underground system, and it has been found equally impracticable.

Much of the analysis for the joint elevated line discussed in Chapter 9 is equally applicable to the underground project for standard equipment. The first point of difference in the design is in the route in Manhattan. An interior route was considered desirable for the subway. This, together with the greater difficulty anticipated in switching the underground terminals, resulted in the choice of a totally different design for the subway terminals. Instead of stub terminals, with the tracks turning off at a large angle with the main line, through terminals were contemplated for the subway plan, with the tracks substantially parallel to the main line and connected at both ends. The limiting capacity of a minimum terminal of this type was estimated to be the same as that of a minimum elevated terminal, consequently the number of terminals remained the same.

Apart from the Manhattan terminals the elevated plan would be duplicated, except that the best location for the north tunnel was thought to be at Twenty-ninth Street, Manhattan — between terminals instead of beyond the most northerly one. This would mean quite a different operating schedule north of the north tunnel and in fact throughout the system, as is shown by the track chart developed for the subway.

Route in Manhattan

The main objection to locating the subway along the waterfront as was done with the elevated line was the difficulty and excessive cost of building it through made ground so near the water's edge. The important advantage of an interior location was the possibility of terminals on both sides of the line, with connections at each end of the terminal. Both considerations led inevitably to an interior route.

To determine the best route a careful examination was made of the nature of the underlying strata and other subsurface conditions, the locations and profiles of other subways and tunnels, present and projected, and the available sites for terminals for the system contemplated. From this examination the following route was selected: Beginning at the southwest corner of the Sixtieth Street yard of the New York Central Railroad, the line would proceed down Twelfth Avenue and the Marginal Way to a point midway between Fifty-fourth and Fifty-second streets; thence turn diagonally across to Eleventh Avenue at Forty-ninth Street; thence proceed down Eleventh Avenue to Thirty-sixth Street; thence diagonally under the blocks to Tenth Avenue and Thirty-third Street; thence down Tenth Avenue to Fifteenth Street; thence down Washington Street to Morton Street; thence diagonally across to Greenwich Street at Leroy Street; thence down Greenwich Street to Barclay Street; thence diagonally back to Washington Street at Fulton Street; thence down Washington Street to Battery Park.

The purpose in starting in Twelfth Avenue instead of Eleventh Avenue was to permit a better arrangement of the Sixtieth Street yard at the time of the necessary reconstruction. Greenwich Street would be followed as far as possible below Fourteenth Street because it is wider than Washington Street and would accommodate a four-track subway without encroaching on property inside of the building lines. Condemning such abutting land would be more expensive than underpinning the elevated structure in Greenwich Street. On the other hand it would be necessary to occupy Washington Street for a short distance at each end of the Greenwich Street stretch to avoid the existing Hudson & Manhattan and Interborough Rapid Transit subways. A freight subway could be built along the route adopted near the surface with no interference with other subways or tunnels.

Manhattan Terminals

Given the possibility of through terminals each side of the subway, the terminals would naturally become long and narrow. The chief reason is that the shape of the city blocks — their narrowness east and west and the necessity for keeping the north-and-south thoroughfares open — would preclude the possibility of driveways side by side as in the elevated stub terminals. Another objection to wide terminals would be the expense of approach tracks on valuable property, requiring expensive easements. Long, narrow terminals would place the inbound and outbound sections tandem instead of side by side. Figs. 1 and 2 show two typical arrangements for these terminals.

A minimum terminal would have on the track level two platforms each 60 ft. wide and 840 ft. or twenty car lengths long, separated by six tracks in a well 80 ft. wide, as in the case of the elevated terminal. One-half of each platform would be for inbound freight, the other for outbound freight.

As in the elevated terminal, the platforms and driveways at street level would correspond closely with the arrangement at track level. Over each track platform would be a truck platform 63 ft. wide over all, with a sawtooth face. Longitudinally between platforms there would be a single driveway with a clear width of 74 ft., the width adopted for the driveways of the elevated terminals. Laterally the layout at street level would be divided into two parts by a cross driveway, and thus there would be one driveway and two platforms for inbound freight and the same for outbound freight. Several cross streets would be closed by each terminal.

In the case of the elevated terminals, all tracks would have to enter the driveways from West Street, and it

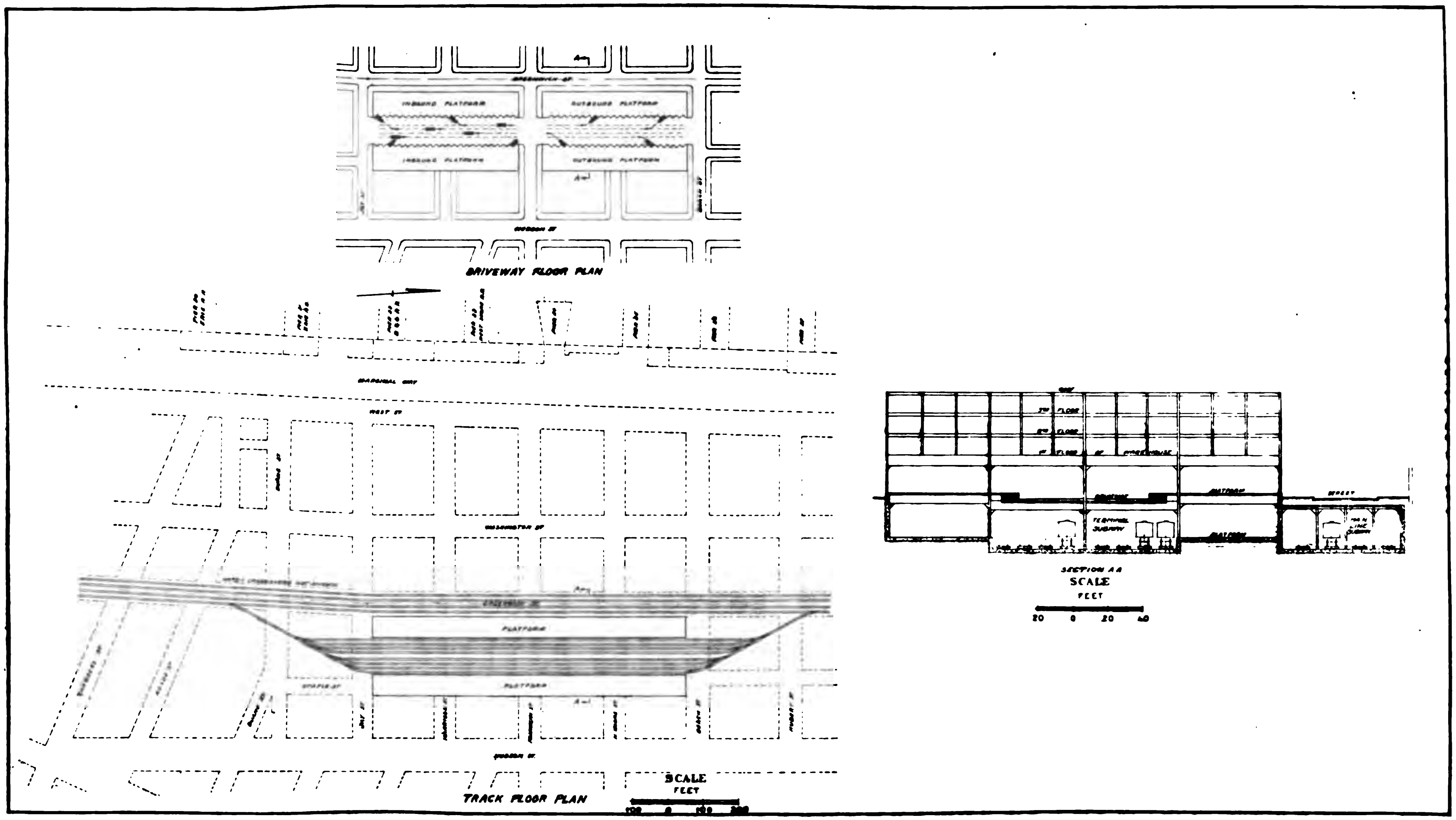


Fig. 1—Track Floor Plan, Driveway Floor Plan and Cross-Section of Typical Right-Angle Terminal for Underground Railroad for Standard Equipment

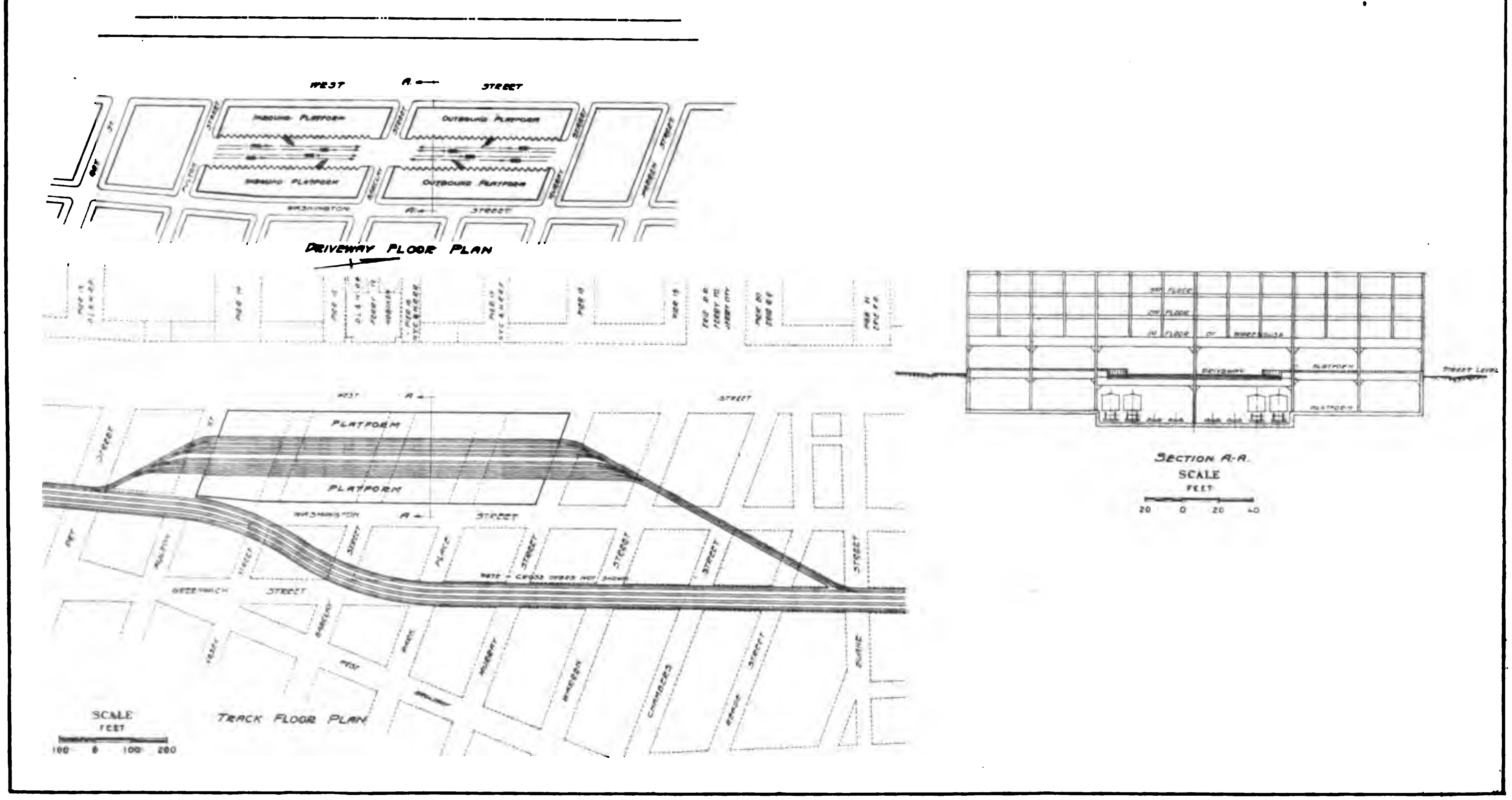


Fig. 2 — Track Floor Plan, Driveway Floor Plan and Cross-Section of Typical *Skew* Terminal for Underground Railroad for Standard Equipment

was shown that there would be conflicting movements of traffic which, it was thought, would cut in half the capacity of each driveway. In these hypothetical subway terminals no conflict would be necessary. Trucks could enter the two driveways from the opposite ends, and while all would depart via the center driveway the two groups could turn in opposite directions, each to the right. If furthermore the trucks were directed into the entrance streets in such a manner that they would make right-hand turns into their respective driveways there would be no interruption of the flow, and the full capacity of each driveway could be used.

Thus the two driveways would have the same trucking capacity as the four in the elevated terminal.

The tailboard capacity in the minimum subway terminal would be less than that in the elevated terminal, but not small enough to preclude utilizing the entire trucking capacity provided reasonable speed was maintained in loading and unloading trucks. Most of the terminals as laid out on paper are considerably longer than the minimum requirement, and so would afford more tailboard space.

NUMBER AND LOCATION OF TERMINALS

Except as to storage of inbound freight, the working capacity of the subway terminal would be equal to that of the elevated terminal. Consequently the same number of terminals would be required.

Fig. 6, Part IV, shows the assumed locations of the twelve terminals. Because the blocks between Washington and Greenwich Streets are too narrow for a minimum terminal it would be necessary south of Fourteenth Street to use only the blocks between West and Washington Streets and those between Greenwich and Hudson Streets for the terminals, and carry the terminal approaches under the narrow intervening blocks.

The difference of design of the subway and elevated terminals shows considerably to the advantage of the subway system in first cost, the subway terminals averaging much smaller, but the advantage disappears when the rental credits are taken into account. Neither type has any pronounced advantage over the other in the economic proof of the two systems.

RAIL CONNECTIONS

The same length of train assumed for the imaginary elevated line was used in considering the subway. The tonnages handled and number of cars to be moved would remain the same. Consequently the same number of trains — 142 inbound and as many outbound — on a day of maximum traffic would have to be handled, and the double tunnel connection and division of the railroads into two groups would be as necessary as in the elevated project.

The reason for changing the location of the uptown tunnel to Twenty-ninth Street is that while the best opportunity for the loop required for the elevated system would be under the blocks above Fifty-fifth Street, the subway system would require no such loop and a better junction with the line coming from the New York Central's Sixtieth Street yard could be effected in the vicinity of Thirtieth Street. The location adopted would necessitate approaches to the tunnel from both the north and the south, and north of the tunnel the New Jersey trains of the northern group would be operated in the same manner as all trains of the southern group, the New York Central trains alone virtually constituting the second group.

MAIN TRACKS AND SCHEME OF OPERATION

Two main tracks as before would be sufficient south of the north tunnel, but north of that point the conflicting movements would make it necessary to have four main tracks. Eleventh and Twelfth Avenues are wide enough to accommodate the two additional tracks. The same is true of Tenth Avenue, which would make it possible to place two extra working tracks alongside Terminals 9 and 10.

The two main tracks would be in the center and would be operated right-handed. Below Terminal 9 there would be one continuous track on each side of the main tracks, and these tracks in conjunction with those within the terminals, with direct crossover movements into and out of the terminals from either main track, would have to serve for all switching and storage purposes. From Terminal 9 north the total number of tracks would be increased from four to six as shown in the drawings.

TRACK CHART

A track chart similar to that developed for the elevated project was worked out and appears as Fig. 7 in Part IV. The density charts show that nowhere would there be quite as heavy a movement as in the elevated scheme, consequently the train intervals could be greater.

Turnaround charts are inserted in the upper right-hand corner of the large chart. Incoming trains, whether northbound or southbound, would run direct into the terminal, and the locomotive would leave the train on one of the two center tracks. It would then run around this train on the other center track and back down on an outgoing train waiting on the track alongside the terminal, next to the main track. The train would then depart, running directly out on the main track. The turnaround would be accomplished in 19 minutes 3½ seconds as the chart shows.

The operating chart shows substantially the same fatal objections to the subway plan as to the elevated plan — utter inadequacy of capacity for present tonnage except under continuous operation 24 hours a day, inability to meet future requirements even on that basis, and susceptibility to complete demoralization through a breakdown at one point.

New Jersey Facilities, Tunnels, Power

Except that the changed location of the north tunnel would make the New Jersey approach from the new yards shorter than that for the elevated scheme, the New Jersey facilities and their operation could be identical for subway or elevated line. The same kind and amount of power and equipment would be required, and the same type of tunnel has been assumed for estimating purposes.

Fig. 3 shows a general map of the line considered.

First Costs

Table 1 is made up on the same basis as Table 2 in Chapter 9, showing the estimated first cost of the

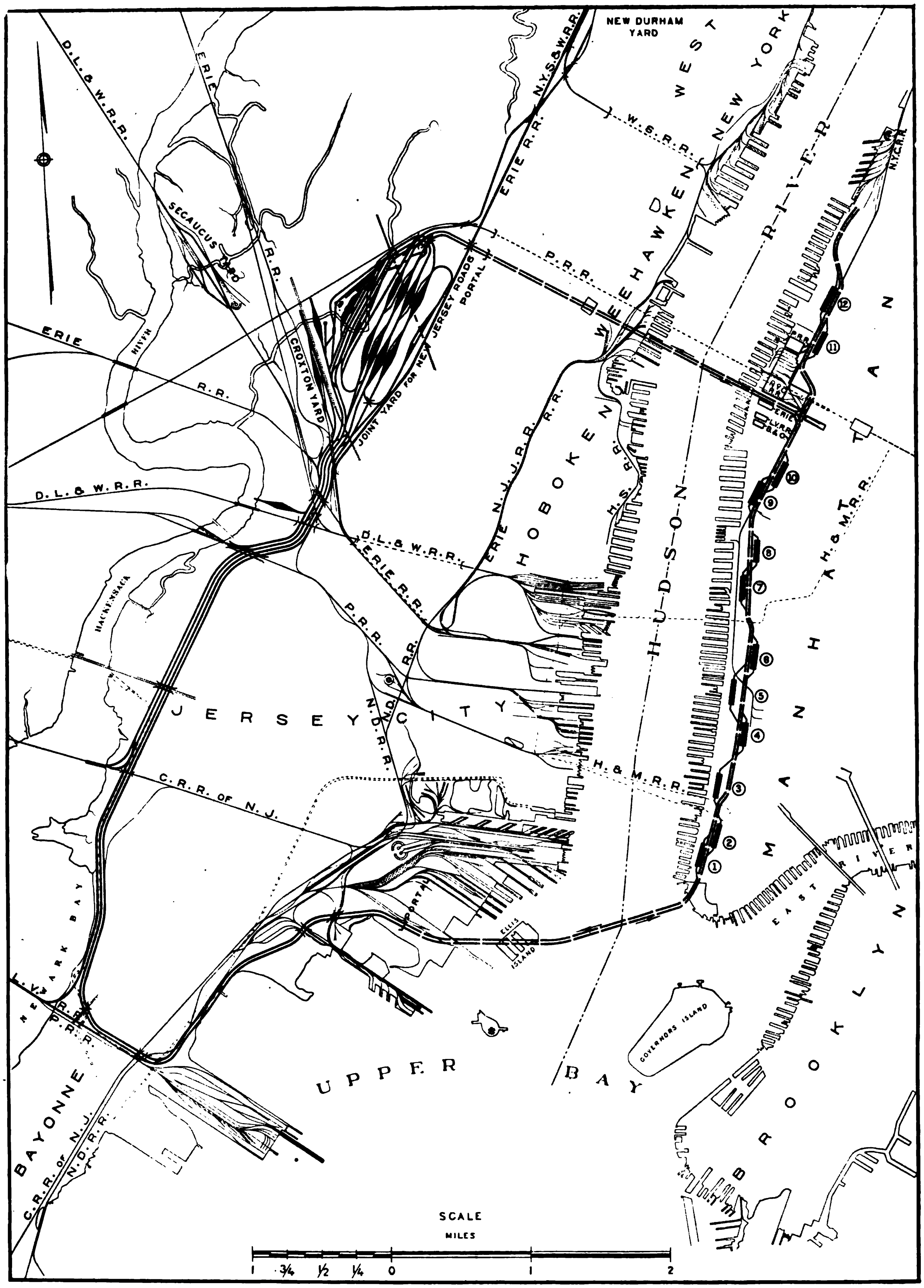


Fig. 3 — General Map of Underground Railroad System for Standard Equipment Hauled by Electric Locomotives

elevated system. It shows first costs for the scheme of $241,131,507, $244,451,702 and $247,771,896 corresponding to interest rates of 5, 6 and 7 per cent. This gives the subway an apparent advantage over the elevated of from about $10,000,000 to about $14,000,000.

The rentals that might be expected from the warehouse space of the three upper floors of the terminals, however, would be only $1,654,903 per year, as compared with $3,903,733 obtainable in the elevated scheme. The reasons for this difference are that the subway terminals as laid out are in general as previously stated much smaller than the elevated terminals, and that much less space would be available for storage purposes.

Table 1 — Summary of Estimated Cost of Joint Subway System

A — New Jersey Classification Yards		
Right-of-way	$150,000	
Tracks and buildings, including shops and their equipment	3,100,674	
Transfer platforms	400,000	
Bridges	276,456	
		$3,927,130
B — Belt Line in New Jersey		
Right-of-way	$700,000	
Excavation, fill and structures	4,357,167	
Tracks	852,928	
		5,910,095
C — Lackawanna and Erie Interchange Yards		
Right-of-way	$102,320	
Fill	42,400	
Tracks	266,690	
		411,410
D — Tunnels to Battery in Manhattan		
Right-of-way	$10,000	
Tunnels	20,958,750	
Tracks	109,259	
		21,078,009
E — Tunnels to Twenty-ninth Street, Manhattan		
Right-of-way in New Jersey	$180,000	
Right-of-way in Manhattan	130,000	
River tunnel and approaches	10,015,000	
Double-track tunnel through Bergen Hill	4,668,300	
Tracks	111,327	
		15,104,627
F — Subway Structure in Manhattan		
Easements	$1,270,500	
Subway structure	62,990,480	
Tracks	742,798	
		65,003,778
G — Twelve Terminals in Manhattan		
Real estate for terminals	$23,346,500	
Easements for terminal and yard approaches	2,664,000	
Terminal buildings	51,402,855	
Terminal connections	25,077,040	
Tracks	590,442	
		103,080,837
H — Electrification and Signal Devices		
Power house and seven substations	$3,250,000	
Third rail and feeders	2,580,400	
Interlocking and signal devices	1,000,000	
		6,830,400
I — Equipment		
Steam locomotives	$550,000	
Electric locomotives	2,400,000	
Tractors	180,000	
Trailers	54,250	
		3,184,250
Total		$224,530,536
Interest during construction on above total, exclusive of equipment based on three-year construction period:		
Interest at 5 per cent		$16,600,971
Grand total		$241,131,507
Interest at 6 per cent		$19,921,166
Grand total		$244,451,702
Interest at 7 per cent		$23,241,360
Grand total		$247,771,896

Operating Costs

The estimated operating costs of the subway system, built up in the same manner as those of the elevated system and based on 1918 prices with 1914 tonnages, would be $23.1412 per car delivered, $32.6690 per loaded car delivered and $3.6658 per ton delivered. as compared with the corresponding costs with present facilities of $14.2193, $20.0736 and $2.2525 respectively, and with the elevated system of $21.9439, $30.9786 and $3.4761.

Despite the lower cost of the subway system, the elevated system shows a slight advantage over the subway. This is wholly due to the greater credit for the warehouse space of the elevated terminals — a credit which on the 5-per cent basis amounts to 64 cents per ton for the elevated system and only 27 cents for the subway system.

Tables 2–5, following the same form as Tables 3–6 of Chapter 9, compare the costs of operating the subway with those of operating the present facilities on the bases of the car and the ton, subdivided into direct costs and fixed charges, and if necessary into successive operations.

Table 2 — Elements by Successive Operations Entering Into Average Cost per Car at 1918 Prices to Operate Joint Underground Railroad System on West Side From Break-Up Yards to Tailboard

	Direct costs	Fixed charges	Total
Classification and switching at break-up yards	$ .8852	$ .1025	$ .9877
Line haul, break-up yards to joint terminal yards	.4416	.3798	.8214
Classification and switching at joint yards	.8558	.3805	1.2363
Transfer-platform operations at joint yards	4.2749	.5856	4.8605
Line haul, joint yards to Manhattan terminals	.6600	2.9318	3.5918
Switching at Manhattan terminals	.7946	5.4828	6.2774
Handling freight at terminal stations	3.6549	6.9317	10.5866
Total, all operations	$11.5670	$16.7947	$28.3617
Average actual total per car delivered	7.1189	16.0223	23.1412

The comparison made between the individual items pertaining to the elevated system and the present facilities apply in the main to the subway system as well. The first four operating stages would be identical in the elevated and subway schemes, except in small items, such as snow removal, drainage and the like. The fifth would be somewhat less expensive in the subway scheme than in the elevated because the line is shorter. Switching at the Manhattan stations would be much more expensive in the case of the subway than in that of the elevated because of the much greater first cost of the subway, while handling charges at the terminals would be only slightly less, including the overhead, because of the great difference in favor of the elevated in the rental credits. The direct operating costs would be almost identical for either the elevated or the underground system.

Table 3 — Elements by Successive Operations Entering Into Average Cost per Car at 1918 Prices to Operate Present Hudson River Pier and Inland Rail Stations (Table 18, Chapter 6, Reproduced)

	Direct costs	Fixed charges	Total
Classification at break-up yards	$ .8942	$ .2197	$1.1139
Breaking bulk at transfer stations	4.2416	.0498	4.2914
Line haul between yards and terminals	.6582	.3145	.9727
Switching and bridging at waterfront	1.6054	.9758	2.5812
Car-float operations	2.0691	.3159	2.3850
Handling freight at terminal stations	5 9441	2.3295	8.2736
Total, all operations	$15.4126	$4.2052	$19.6178
Average total per car delivered	10.3281	3.8912	14.2193

Comparison of Elevated and Subway Systems

That the first cost of the elevated system would be higher than that of the subway is attributable almost entirely to two things, the two loops in the elevated system and the greater size of the terminals. The two loops, made necessary by the difference in elevation between the tunnels and the elevated structure, put the elevated system at a disadvantage of about $14,000,000, while the twelve elevated terminals, including interest at 5 per cent during construction, would cost about $42,000,000 more than those for the subway. The difference in cost of the terminals would almost exactly offset the advantage of the elevated over the underground structure, and the cost of the two loops virtually represents the difference in the totals for the two systems.

TABLE 4 — ELEMENTS ENTERING INTO AVERAGE COST PER TON AT 1918 PRICES TO OPERATE JOINT UNDERGROUND RAILROAD SYSTEM ON WEST SIDE FROM BREAK-UP YARDS TO TAILBOARD

	Direct costs (a)	Interest Rate 5 Per Cent: Fixed charges (b)	Interest Rate 5 Per Cent: Total costs (c=a+b)	Interest Rate 6 Per Cent: Fixed charges (d)	Interest Rate 6 Per Cent: Total costs (e=a+d)	Interest Rate 7 Per Cent: Fixed charges (f)	Interest Rate 7 Per Cent: Total costs (g=a+f)
Classification and switching at break-up yards	$ .1403	$ .0162	$ .1565	$ .0185	$ .1588	$ .0211	$ .1614
Line haul, break-up yards to joint terminal yards	.0693	.0597	.1290	.0691	.1384	.0779	.1472
Classification and switching at joint terminal yards	.1343	.0598	.1941	.0692	.2035	.0780	.2123
Transfer-platform operations at joint yards	.6720	.0920	.7640	.1248	.7968	.1407	.8217
Line haul, joint yards to Manhattan terminals	.1046	.4644	.5690	.5378	.6424	.6065	.7111
Switching at Manhattan terminals	.1259	.8685	.9944	.9998	1.1257	1.1191	1.2450
Handling freight at terminal stations	.5789	1.0981	1.6770	1.2894	1.8683	1.4808	2.0597
Total, all operations	$1.8253	$2.6587	$4.4840	$3.1086	$4.9339	$3.5241	$5.3494
Average actual total per ton delivered	1.1278	2.5380	3.6658	2.9516	4.0794	3.3471	4.4749

Evidently a minimum elevated terminal with four driveways would cost more than a minimum subway terminal with only two. The difference need not be as great, however, as the plans and estimates show. The excessive difference is due to the fact that the arrangement of the streets on the lower West Side would permit extending the platforms, driveways and tracks of the elevated terminals and providing additional factors of safety for expansion thereby, whereas they would not lend themselves readily to a similar extension of the underground terminals.

TABLE 5 — ELEMENTS ENTERING INTO AVERAGE COST PER TON AT 1918 PRICES TO OPERATE PRESENT HUDSON RIVER AND INLAND RAIL STATIONS (TABLE 19, CHAPTER 6, AMPLIFIED)

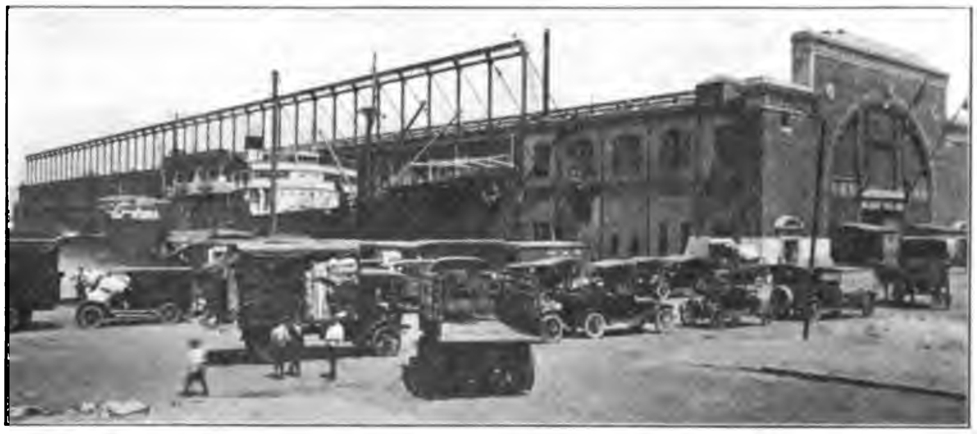
	Direct costs (a)	Interest Rate 5 Per Cent: Fixed costs (b)	Interest Rate 5 Per Cent: Total charges (c=a+b)	Interest Rate 6 Per Cent: Fixed costs (d)	Interest Rate 6 Per Cent: Total charges (e=a+d)	Interest Rate 7 Per Cent: Fixed costs (f)	Interest Rate 7 Per Cent: Total charges (g=a+f)
Classification at break-up yard	$ .1364	$ .0335	$ .1699	$ .0379	$ .1743	$ .0423	$ .1787
Breaking bulk at transfer station	.6667	.0078	.6745	.0089	.6756	.0099	.6766
Line haul between yards and terminals	.1024	.0490	.1514	.0548	.1572	.0606	.1630
Switching and bridging at waterfront	.2528	.1537	.4065	.1696	.4224	.1855	.4383
Car-float operation	.3280	.0500	.3780	.0567	.3847	.0634	.3941
Handling freight at terminal station	.9416	.3690	1.3106	.3775	1.3191	.3860	1.3276
Total, all operations	$2.4279	$ .6630	$3.0909	$ .7054	$3.1333	$ .7477	$3.1756
Average total per ton delivered	1.6361	.6164	2.2525	.6529	2.2890	.6894	2.3255

If the figures proved the economic justification of either plan it would be desirable to modify the terminals of one plan to bring the two to a more fair basis of comparison. In that case it is probable that the first cost as well as the operating costs would be more for the subway than for the elevated. Since neither project can be justified on economic grounds, it is hardly worth while to go farther into the difference in the sizes of the terminals. Nor is it worth while to discuss the relative aesthetic merits of the two plans.

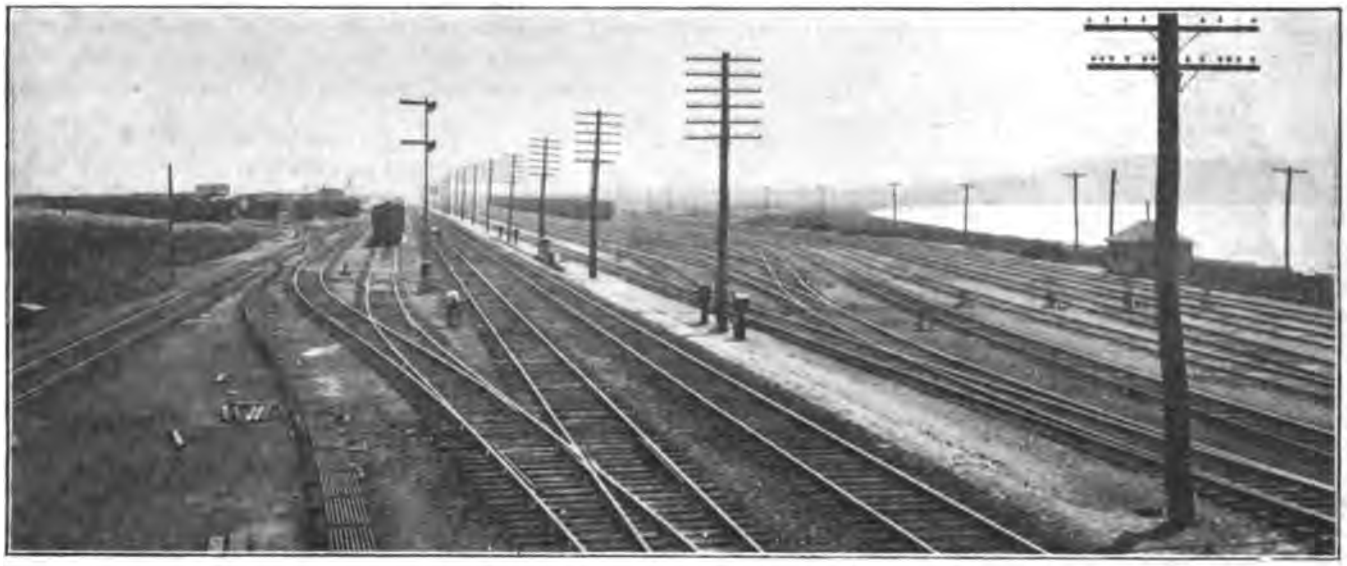
Conclusion

The conclusions in Chapter 9 relative to the economic soundness of the elevated plan apply equally to the subway plan. The system as designed would barely accommodate the 1914 tonnage, and would have to be duplicated to make adequate provision for the future. Yet the first cost of a plant or series of plants of whatever capacity would be so great as to impose an intolerable burden of overhead charges on the freight, even though the plant or plants were worked to full capacity.

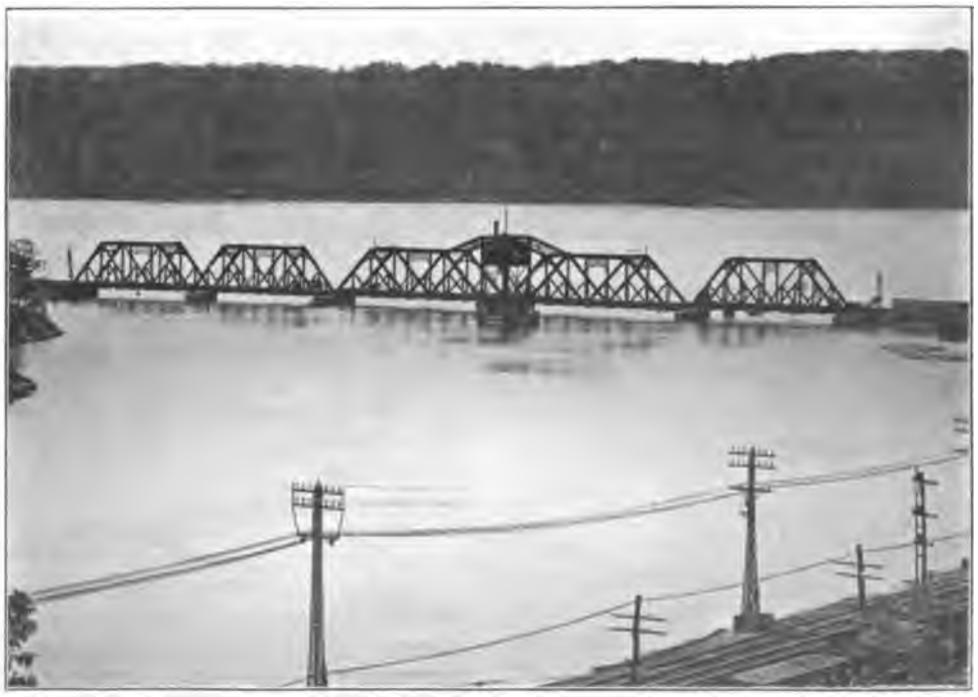
The Commission cannot recommend the system.



Shore End of Manhattan's Most Modern Pier — Note Cargo Masts Along Side



Westerly Entrance to Break-Up Yard on Hackensack Meadows — Receiving Yards on Right, Transfer-Platform Yard on Left



Low Drawbridge at Spuyten Duyvil — New York Central's West Side Freight Line

CHAPTER 11

Possibilities of Bridge Connection Over Hudson River for Joint Elevated Marginal Railroad

Some of the advocates of a joint marginal railroad on the West Side of Manhattan favor a bridge rather than a tunnel for the north connection with the New Jersey railroads. Dr. Gustav Lindenthal appeared before the Commission early in 1919 with a comprehensive plan for the West Side that included such a bridge, and with estimates covering the cost of the entire project. His plan and estimates make it possible, without developing the details, to determine whether the substitution of bridge for tunnel would make the marginal railroad project economically sound. The Commission believes that it would not.

Early in 1919 Dr. Lindenthal estimated the cost of a bridge at $75,000,000. He planned to use this bridge for both passenger and freight traffic, and for highway purposes and rapid transit as well. The bridge would have two decks. On the lower deck would be eight tracks, four for freight and four for passenger service, it being the purpose to bring the passenger trains of all the New Jersey railroads into a union station near the present Pennsylvania Station. The upper deck would carry roadways, sidewalks, surface-car tracks and tracks for elevated trains. On this basis Dr. Lindenthal would charge half the cost of the bridge to highway traffic, and a fourth to passenger traffic, leaving only a fourth or $18,750,000 chargeable to freight traffic.

The estimated cost of the north tunnel, which this bridge would take the place of, is $17,066,414, as recorded in Chapter 9. The south tunnel would be as necessary as with the plans discussed in Chapters 9 and 10, to equalize the load on the main-track system in Manhattan. For the type of marginal railroad already analyzed, therefore, whether elevated or subway, the bridge shows no economic advantage whatever over the tunnel. In fact, the bridge would require a loop connection with the New York Central, which Dr. Lindenthal estimated would cost $5,000,000. It is probable, also, that the greater cost to connect the elevated or subway system with the bridge, at its high elevation, than with the north tunnel in the plans analyzed in Chapters 9 and 10 respectively, would make a considerable item. Hence it can be said conservatively that the bridge project would impose on the traffic the interest, taxes and depreciation on an additional investment of $10,000,000. The maintenance of the bridge would also be more costly.

Trucking from New Jersey

Dr. Lindenthal's plan of operation differed materially from that developed in Chapter 9. The principal difference was that he would have a considerable percentage of the Manhattan freight trucked over the new bridge. He would have the new joint classification yard in New Jersey laid out with driveways between tracks, so that motor trucks could load from and unload to the cars direct at that point. The freight so handled would be high-class freight, particularly food products.

Such a yard, combining loading and unloading facilities with trackage for classifying cars to and from Manhattan and transfer facilities for breaking bulk in many of those cars, would be difficult to design and operate, and considering the problem of finding sufficient space for the smaller joint yards required by the other projects analyzed, it is doubtful whether a suitable location for such a yard could be found. Assuming that it could, the Commission is unable to see any economic advantage in splitting up the traffic in this manner.

A material reduction in the number of cars to be brought to Manhattan would make possible a material reduction in the size and cost of the Manhattan terminals, which are admittedly the largest item in the cost of the marginal railroad project. The first cost of terminals could not conceivably be reduced more rapidly than the tonnage they would serve, and the tonnage remaining would have to carry its proportional share of the investment in terminals and the entire cost of the main trackage, south tunnel and other parts of the freight system. The Commission cannot accept Dr. Lindenthal's estimate of $15,000,000 for the elevated line and terminals in Manhattan, inasmuch as its own estimate places the cost of the elevated line without terminals at $25,000,000.

As to the handling of some of the freight over the bridge by motor truck, the Commission feels that it has analyzed the highest development of motor-truck service in Chapter 12, and has found the service uneconomical. Dr. Lindenthal's plan would in effect impose on the motor-truck tonnage the additional burden of part of the investment, and we have seen that the existing ferries, without either bridge or vehicular tunnel, could handle the entire Manhattan tonnage. It is true that Dr. Lindenthal does not go to the expense of inland motor-truck terminals, but counts on store-door delivery. Store-door delivery, its possibilities and its drawbacks, are discussed elsewhere in this report, but it seems unwise to inject it into the West Side problem at this time. Suffice it to say that whatever its possibilities with respect to the Hudson River bridge plan, they are equal or greater in conjunction with the plan analyzed in Chapter 12.

Conclusion

Other phases of Dr. Lindenthal's plan go outside of the scope of the West Side problem. The basic feature of his plan, so far as Manhattan freight is concerned, is a bridge over the Hudson River. As a part of a marginal railroad to handle all West Side pier and inland rail station freight of the New Jersey railroads the case for the bridge fails, even when seventy-five per cent of the cost can be put upon other traffic; whereas the contemplated combination of a marginal railroad and motor-truck delivery would be unfortunate in that it would apparently increase the cost per ton of both services.

CHAPTER 12

Special Motor-Truck Service for Handling General Package Freight Between New Jersey and Manhattan

Analysis has been made of the possibilities of installing a special motor-truck service for the handling of general package freight between lower Manhattan and the railroad yards in New Jersey, and the elimination thereby of railroad cars of every sort for that service. The system would include the New York Central, making it possible to eliminate the running tracks from Sixtieth Street south, although the yard at Thirtieth Street, like the other inland yards in that vicinity, would remain in service with float-bridge connection, as in the plan recommended by the Commission. The trucks would be large and in general of uniform design and capacity, with detachable bodies, operating on a schedule to and from terminals established in Manhattan, at which there would be machinery for moving the truck bodies on and off the chassis with a minimum of delay.

The supposed advantage of this system over others releasing the Manhattan or West Side waterfront from railroad use was the possibility of utilizing existing railroad yards and existing ferries and of establishing the system gradually, with a minimum of disturbance during the transition and a minimum outlay to cover the cost of trucks and the Manhattan terminals. Considering the matter solely from the standpoint of serving Manhattan, this plan might be feasible and desirable. It would mean, however, using valuable property on or near the New Jersey waterfront; and the Commission, studying the Port as a whole, believes that this waterfront, as set forth elsewhere, should be used otherwise. Hence a joint yard as in other plans analyzed would have to be built on the Hackensack meadows. This would involve much additional first cost and would further greatly increase the trucking distances and consequently the operating costs.

For this particular service, therefore, the system would not be as satisfactory as the automatic-electric system recommended by the Commission. As an auxiliary to the latter system, for distribution between the Manhattan terminals of that system and secondary terminals throughout the city and for store-door delivery to large consignees, the motor-truck system has great merit. The Commission recommends its use for that purpose, as set forth in Chapter 14.

Cincinnati Plan

To help arrive at what such a plan might accomplish, the Commission asked Mr. B. F. Fitch, president of the Motor Terminals Company, to explain the system installed by his company in Cincinnati several years ago. The terminal freight stations on the several railroads entering Cincinnati are distributing and collecting points for freight destined for or originating at a number of small stations in the city and its suburbs. Formerly this short haul was effected in trap cars, for which there were often only very light loads; or by contracts with trucking companies. For this trap-car service and the trucking contracts the Motor Terminals Company substituted its system, which provided motor trucks with detachable bodies operating under the direction of a despatcher.

The system was put into service in May, 1917, and now serves thirty odd stations on eight railroads. Mr. Fitch stated to the Commission that it had effected a 30-per cent saving in labor and an average saving of 52.4 hours in the movement of freight, besides releasing a large number of cars for main-line movement.

A number of refinements in the details of the system, on which patents have been granted, have been or could be installed. The principal one is the use of overhead cranes at the stations to transfer the truck bodies to and from the chassis. It is evident that the system requires a comparatively small number of chassis, provided there are facilities for promptly getting the truck bodies on and off the chassis so that the latter can be kept in motion virtually all of the time, while the former are being loaded and unloaded at the station.

Application to New York's Problem

To apply the Cincinnati system to the needs of lower Manhattan, Mr. Fitch suggested the following program:

1. Construct freight-car, motor-truck transfer platforms on available cheap realty adjacent to the rail bulkheads of all contributing lines.

2. Construct zone, inland or off-track stations in Manhattan for the joint occupancy of all contributing lines.

3. Establish, as an arbitrary rider to existing tariffs, cartage rates from the marginal way to each zone within which an inland station is located.

4. Through a terminal trucking company to be operated under the jurisdiction or despatch direction of all contributing lines

(a) Run all less-than-truck-load freight direct from cars to truck bodies, thence to trucks, thence to zone stations for delivery to consignees or delivery to cartage contractors at published zone tariff increases for their later store-door delivery.

(b) Run all freight for large consignees to individual truck bodies (one of which will be set for each at the freight-car motor-truck transfer platform), thence to trucks, thence to store door at published zone tariff increase, plus an extra to be agreed to by contract between the terminal trucking company and the principal Manhattan shippers, who will be scheduled as daily receivers from and deliverers to each railroad in unit-body truck loads.

5. Let the railroads pay to such a terminal trucking company in lieu of present lighterage allowances all funds received from the public cartage rate from the rail bulkhead to the inland station, such rate being an

arbitrary rider to the tariff, as is now the lighterage rate, and let the principal consignee pay direct to the terminal trucking company the contracted amount for store-door delivery of such freight within each zone.

It was Mr. Fitch's belief that these freight-car motor-truck transfer platforms could be placed in the waterfront yards in Jersey City, Hoboken and Weehawken, to each of which two or more ferry lines reach, and that the existing ferries would have sufficient surplus capacity to take the motor trucks of his system. A similar freight-car motor-truck transfer station would be built at the Sixtieth Street (Manhattan) yard of the New York Central. The truck bodies would have a capacity of 5 tons each.

JOINT YARD ON MEADOWS NECESSARY

As set forth at other points in the report, one of the aims of the Commission in proposing a radically different system for handling Manhattan pier-station freight is to release the waterfront terminals of the New Jersey railroads to the broader uses of the Port as a whole. The Commission is not prepared to say without more study than the case seems to warrant whether or not it would be feasible to establish transfer platforms for the individual railroads in or near their waterfront yards. Whether or not space could be found for them, their occupancy of such space would be incompatible with these broader uses of that waterfront. Consequently the Commission has analyzed the plan on the basis of a joint yard, set back from the waterfront. Such a yard would occupy an area approximately equal to that required for the joint yard in the plan recommended by the Commission, and it would presumably be located on the same site, as there is no other site as desirable.

Moving the transfer platforms back to this point immediately puts the entire plan at a great disadvantage. They would then be from four to six miles from the ferries, as shown by Table 1, which indicates the shortest practicable route to each of the railroad ferries with the exception of the West New York ferry of the West Shore, which could not be effectively utilized.

TABLE 1 — SHORTEST PRACTICABLE ROUTE BETWEEN JOINT YARDS AND EXISTING FERRIES

Railroad	Location of ferry	Number of slips	Distance in miles to joint yard
Central of New Jersey	Jersey City Terminal	4	5.50
Pennsylvania	Jersey City Terminal	6	4.43
Erie	Jersey City Terminal	3	4.36
Lackawanna	Hoboken Terminal	6	6.25
Lackawanna	14th Street, Hoboken	2	4.93
West Shore	Weehawken	5	4.17
Total number of slips		26	
Average distance, based on number of slips			5.00

Not only would five miles be added to the travel of every truck except those serving the New York Central, but a climb would have to be made over Bergen Hill. Careful study of routes indicated that three would be used over this ridge, reaching heights above the sea level of 100, 160 and 180 ft. respectively, the southerly route having the lowest summit. The ridge is steep on both sides, and the grades would be heavy, while the routes would be circuitous.

SAME TONNAGES AS IN AUTOMATIC-ELECTRIC PLAN

The system has been roughly projected on the basis of 9,000,000 tons annually, representing the tonnage expected in 1924 at the Hudson River and East River stations the system would replace. This is equivalent to 30,000 tons per day, and the expansion factor of 1.75 to allow peak loads brings it up to 52,500 tons. Of this 5,000 tons on a normal day and 8,750 on a peak-load day, representing the New York Central tonnage, would not use the ferries. The net daily requirements of the ferries would therefore be 25,000 tons on a normal day and 43,750 tons on a peak day, or 15,000 tons inbound and 10,000 tons outbound on a normal day, and 26,250 tons inbound and 17,500 tons outbound on a peak day.

The plan was considered only on the basis of transfer between the transfer platforms and primary distribution and collection terminals in Manhattan, just as in the case of the automatic-electric plan. No account was taken of the possibilities of store-door delivery. Store-door delivery, it is conceded, would be well adapted to this plan, and with it the terminals could be greatly reduced in size or number and the terminal overhead burden correspondingly decreased. It was not considered desirable, however, to make the plan depend upon store-door delivery for its justification. The whole subject of store-door delivery is discussed elsewhere in the report.

TERMINALS

Terminals similar to those designed for the automatic-electric plan could be used for the motor-truck plan, with some difference in the elevator arrangement. Because of the trucking of freight both into and out of the terminal, however, the amount of freight that could be handled at one terminal under the automatic-electric plan would cause great congestion of trucks on the streets in the vicinity of the terminal under the motor-truck plan. To avoid this a greater number of terminals would have to be established. They could be located wherever desired, without consideration of fitting any established main-line system as in the case of either the standard marginal railroad or the automatic-electric plan.

Measurements scaled from a map showing tentative locations for such terminals indicated that they would average 1.65 miles from the nearest ferries.

FERRY REQUIREMENTS

According to Table 4, Chapter 19, the thirteen Hudson River railroad ferries, with a total eastbound or inbound capacity of 20,177 vehicles during the twenty-four hours covered by the clockings, carried 11,706 vehicles, and had unoccupied space for 8,471. Excluding the West New York Ferry as not suitable for this motor-truck service, the figures are reduced to 19,677 trucks that could have been carried, 11,616 that were and 8,061 unoccupied spaces. Of this latter figure, 6,539 occurred during the sixteen hours, from 7 A. M. to 11 P. M., in which the terminals might be operated during peak loads.

The trucks of the proposed system would be larger than the average truck, and it is not safe to assume that more than 5,000 additional trucks could have been carried in the trips as they were actually made. A peak-load daily inbound tonnage of 26,250 would require 6,563 4-ton truck loads, or 1,563 more than the boats running provided space for. The ferry schedules might have to be expanded possibly 10 or 20 per cent by 1924 to take care of maximum loads, although the vehicular tunnel now under construction would probably obviate that necessity. In any even, the existing boats could doubtless be run enough longer to take care of the expansion, irrespective of the vehicular tunnel, and the ferries can be considered quite adequate to the requirements of the system.

While the ferries could take the additional loads with or without a slight expansion of their service, the addition of more trucks per ferry trip would be highly objectionable. The congestion at the ferry entrances on both sides of the Hudson River is even now, with the boats only from 60 to 80 per cent loaded, very great. To increase the number of trucks without fully meeting the increase with additional boats would make the conditions much worse.

TRUCKING CYCLES

Time tests made in conjunction with the trucking studies indicate that the motor trucks would make an average speed in New Jersey of four miles per hour and, under the improved street conditions in Manhattan, 6.5 miles per hour. Taking these average speeds and average distances of 5 miles between the New Jersey transfer platform and the ferries and 1.65 miles between the Manhattan terminals and the ferries, also taking 18 min. as the average time of a ferry trip and making allowances for the time getting trucks on and off the ferryboats and into and out of terminals, including the time of placing and removing detachable bodies, it was estimated that the average round-trip trucking cycle between a Manhattan terminal and the New Jersey joint yard would be 263.1 min., during 192.6 min. of which the truck would be moving under its own power, and during the remaining 70.5 min. of which it would not be so moving.

For the New York Central operations the ferry trip would be eliminated, an average distance of 4.4 miles from the Sixtieth Street yard to the terminal would be used, and a total running time of 106.7 min., divided into 87.2 min. in which the truck would be moving under its own power and 19.5 min. in which it would not, would be obtained.

OPERATING COSTS

The Commission did not deem it necessary to go into the first or the operating costs of this plan in great detail, since a brief comparison with the automatic-electric plan showed the superiority of the latter from the economic point of view. The plant and operations of the two plans would be comparable from the break-up yards to and including the transfers at the transfer platform, even though the motor-truck plan would require quite a different type of yard from that evolved for the automatic-electric system. So, too, the operations at the Manhattan terminals would be comparable. We can therefore consider the cost of operation of the trucks, themselves as set against the cost of operation of the automatic-electric trains.

Operating costs of motor trucks divide into two classes: (1) Fixed and overhead charges, which go on irrespective of mileage covered, and (2) operating expenses, which are proportional to mileage. In the former group come the chauffeurs' wages, interest on investment, depreciation, insurance, licenses and garage charges. In the second group come gasoline, oil and grease, tires and major and minor repairs.

Average figures were obtained covering more than 800 motor vehicles operated in 1917, and figures were also obtained from two of the largest truck manufacturers. From these various figures were selected those thought to bear most closely on the conditions under which this system would operate. The resultant figures are presented in Tables 2 and 3, the former giving the estimated fixed and overhead costs per month, the latter the operating costs per mile.

TABLE 2 — ESTIMATED FIXED AND OVERHEAD CHARGES PER MONTH AGAINST ONE MOTOR TRUCK

Chauffeur — 8-hour day		$140 00
Overhead charges		
Interest on investment	$31 50	
Depreciation (including obsolescence)	87 50	
Insurance (public liability, fire and collision)	41 75	
License	4 17	
Garage	40 00	
		204 92

TABLE 3 — ESTIMATED OPERATING COSTS PER MILE PER MOTOR TRUCK

Gasoline	$.0682
Oil and grease	.0058
Tires	.0611
Repairs (major and minor)	.0433
	$.1784

From these tables and other information developed in the studies of the plan, Table 4, showing the estimated trucking costs per round trip, and Table 5, reducing the costs to a ton basis, have been evolved. It is thus possible to compare the entire plan as to cost of operation with the automatic-electric plan. This is done in Table 6. The average actual total per ton delivered is less than the total for all operations for the reason that 1,500,000 tons per year, the approximate New York Central tonnage, would not undergo the second

TABLE 4 — ESTIMATED TRUCKING COSTS PER ROUND TRIP

	New Jersey trucks			New York Central trucks		
	Fixed charges (263.1 min., entire time of trip)	Operating expenses (192.6 min., running time under own power)	Total cost	Fixed charges(106.7 min., entire time of trip)	Operating expenses (87.2 min., running time under own power)	Total cost
Chauffeur @ $140 per month of 25 8-hour days, or 70¢ per hour	$3.073	......	......	$1.246	......	......
Overhead charges @ $204.92 per month of 25 16-hour days, or 51.2¢ per hour	2.246	......	......	.911	......	......
Operating costs @ 17.84¢ per mile or $1.16 per hour when running at average speed of 6 5 miles per hour	......	$3.720	......	......	$1.686	......
Total cost of round trip	......	......	$9.039	......	......	$3.843

TABLE 5 — ESTIMATED TRUCKING COSTS PER TON

	New Jersey truck	New York Central truck
Trucking costs (average loads, 4 tons inbound; 2.64 tons outbound; 6.64 tons total)	$1.361	$.579
Ferry charges ($2 per loaded truck, round trip)	.300	....
Total	$1.661	$.579
All trucks, based on tonnage percentages of 83.4 per cent for New Jersey roads and 16.6 per cent for New York Central		$1.4814

and third operations — line haul between break-up and joint terminal yards, and classification and switching at the joint yard.

It is not contended that the indicated difference of about 46 cents between the two plans is a precise figure. The Commission is confident, however, that more extended analysis would show the motor-truck plan at a still greater disadvantage. For example, the figures do not take into account the carrying costs of motor trucks and truck bodies not in actual use, nor the wages of helpers on the trucks.

TABLE 6 — ESTIMATED TOTAL CHARGES PER TON AGAINST MOTOR-TRUCK AND AUTOMATIC-ELECTRIC PLANS, ON BASIS OF 9,000,000 TONS PER YEAR

Operation	Motor-truck	Automatic-electric
Classification and switching at break-up yards	$.1172	$.1172
Line haul, break-up to joint terminal yard	.0997	.0997
Classification and switching at joint yard	.1481	.1481
Transfer-platform operations	.2631	.2631
Making up and breaking up automatic-electric trains in joint yard	....	.0296
Moving freight to Manhattan terminals	1.4814	.9699
Making up and breaking up automatic-electric trains at Manhattan terminals	....	.0202
Operation of Manhattan terminals	.6522	.6522
Total, all operations	$2.7617	$2.3000
Average actual total per ton delivered	$2.7207	$2.2590
Saving in car detention, credit	.1341	.1341
Net charges per ton delivered	$2.5866	$2.1219

Conclusion

Mechanically there is no reason why the motor-truck plan should not be practicable. While apparently no cheaper of operation than the present system, it has several important advantages, such as the release of the Manhattan waterfront occupied by pier stations and the provision of new stations more centrally located that would argue in favor of its adoption in the absence of a still better plan.

It has disadvantages that cannot be reduced to dollars and cents. It would not, like the automatic-electric plan, be independent of fog, ice or other river hazards, except to the extent that the vehicular tunnel could be used. The throwing of an additional load on the ferry system is one of its greatest drawbacks, not because of lack of capacity of the boats themselves to carry the load under *ordinary* conditions, but because of the necessity for New York, her industries and her markets, to function under *all* conditions, *extraordinary as well as ordinary,* and because of the almost inevitable increase of delays and confusion at the ferry entrances. The plan could hardly go far toward ameliorating street congestion in either Manhattan or the New Jersey communities.

Its principal intangible advantages would be the releasing of waterfront now occupied by pier stations, and the establishing of more central terminals. The plan recommended by the Commission will accomplish both of these things along with other intangible advantages enumerated, and at a lower cost. The Commission cannot recommend the motor-truck plan as the logical solution of the Manhattan freight problem.

CHAPTER 13

Underground Cable and Truck Conveyor System for Handling Manhattan Package Freight

A system for handling Manhattan railroad package freight on small four-wheeled trucks hauled individually at short intervals by a series of cables was proposed by one of the three manufacturers of freight-handling machinery asked by the Commission to submit plans applying the moving-platform idea. The Commission concluded, however, that the automatic-electric system had the advantage of it in several important particulars —the chief being capacity in terms of units of first cost. Reaching this conclusion as the result of a preliminary study, accurate enough to warrant such a conclusion, the Commission did not think it desirable in the limited time available to make a complete analysis of the plan.

General Description

In its essential features the plan, which may be designated as the cableway plan, would involve the transfer of inbound freight at a joint station in New Jersey from the standard freight cars to trucks about 3 x 6 ft. The trucks, after receiving their loads, would be drawn over one of a series of cables, which a mechanism on the truck would engage. The cables would carry the trucks through one of several tunnels under the Hudson river to one of twelve terminals in Manhattan, where they would be unloaded and reloaded with outbound freight. Cables runnng in the opposite direction in the same tunnels would take them back to the New Jersey yard, where their contents would be transferred to standard freight cars and they would receive new inbound loads.

A joint yard and belt line connecting New Jersey railroads would be essential to this as to other plans considered, as would a separate connection for the New York Central.

The main system would not be a loop system, but a series of spurs from the New Jersey yard, each branching at the Manhattan end to serve a certain number of terminals. The New York Central, however, would require a main stem throughout the terminal district, with branches to each terminal.

Special Mechanical and Engineering Details

Such a cable system would require curves, grades and changes in speed. These appear to have been provided for in a satisfactory manner. Obviously a single cable could not carry a truck through its entire cycle, but relatively short, independent cable lines would be used, so arranged that one would engage the truck as another released it, and so keep it in continuous motion.

On each cable, at intervals of about 30 ft., would be a large casting with an upward projection. Each truck would have a handle for drawing it. Under the front of the truck would be a mechanism, controlled by the handle, for engaging the cable. With the handle down there would be no contact. By raising the handle a lug would be pushed downward into the path of the series of castings on the cable, and the first casting would catch the lug and pull the truck along. A small wheel attached to the base of the casting would travel in a slot, and other slots for the wheels of the truck would keep truck and cable in line. The cable and its attachments would be enclosed in a gallery with only a narrow slot in the floor at the top, in which slot would run a small guide wheel attached to the truck for further guiding it.

When the truck reached an incline the main cable, continuing horizontally a short distance, would drop the casting on the cable out of contact with the lug on the truck, while at the same time another cable parallel with the incline would form a new contact, either hauling the truck up or easing it down the incline as the case might be.

Trucks suitable for this service would require a space not to exceed 7 ft. wide and 8 ft. high. A tunnel with an outside diameter of 29 ft. would carry six cableways, two at the bottom, three just above the center and one at the top, with walkways alongside each cableway, so that every part of the system would be accessible.

Allowing one cableway in each direction between each Manhattan terminal and the New Jersey yard, four of these tunnels would be required under the Hudson River. Each tunnel would serve three terminals. As the New York Central traffic is about 20 per cent of that of the New Jersey roads, a single tunnel with six truckways at the north end, then four, and finally only two at the south end of the Manhattan terminal district would be sufficient. Each pair of cableways would serve four terminals.

At the New Jersey joint yard the tentative plan, which might be materially modified after detailed study, was to build two sets of twenty-four 1,000-ft. platforms each, one for inbound and one for outbound freight. The individual platforms of each of these two groups would be separated by railroad tracks. Along the center of each platform, which would be level with a car floor, would run a cable and slots for trucks.

The tentative plan proposed stub railroad tracks. The trucks would enter the outbound section and leave the inbound section at the same end as the railroad tracks, looping around from one section to the other at the opposite end. At the railroad end it would be necessary both to avoid grade crossings and to provide great flexibility of the truckways, so that on the one hand trucks entering the station from any of the twelve outbound tunnel lines could reach any of the twenty-four platforms, and on the other hand trucks from any of the twenty-four inbound platforms could reach any of the twelve inbound tunnel lines. This would be accomplished by double-decked viaducts over the railroad tracks, the main truckways being carried high enough to allow turnouts from each to drop down under the system and connect with each platform truckway and still clear the railroad tracks. The inclined truckways could follow heavy grades.

At the opposite ends of the platforms there would be no switching problem, as the trucks would be empty and interchangeable. A storage and repair yard, however, would be provided for surplus trucks.

Capacity of System

In the development of the automatic-electric system recommended by the Commission, as stated in Chapter 14, it is assumed that all parts of the system should be able to handle the expected 1929 traffic — 10,000,000 tons per annum. Hence the terminals are laid out with such initial capacity, while the tunnels, main tracks and yards have an estimated capacity of 14,246,000 tons, which can be attained at the Manhattan end by additional terminals. The cableway system should be able to handle at least 10,000,000 tons per year, with the peak-load expansion factor of 1.75 to be met by 16-hour working days.

The peak loads on this basis would be 29,166 tons inbound per day from the New Jersey railroads and 5,834 tons from the New York Central. The cable lines would travel 120 ft. per min., and tracks could be placed upon them about 30 ft. apart. There could therefore be four trucks per minute.

With the same loading of 1,250 lb. per truck as assumed for the automatic-electric system, one truck line would haul 240 trucks per hour or 3,840 per day, which is equivalent to 2,400 tons. The twelve inbound cables from New Jersey would therefore haul 28,000 tons per day, falling short of the requirements by 366 tons. This deficiency of less than 2 per cent could doubtless be made up by a slight increase in the average loading of the trucks, but it is evident nevertheless that the inbound capacity from New Jersey would be only sufficient for the 1929 requirements. Capacity for the New Jersey roads' share of 14,246,000 tons could be had only by two additional Hudson River tunnels as well as additional terminals.

An outbound peak-load tonnage of 23,040 tons, as compared with 19,444 tons anticipated, could be carried by the system, even with the lighter loading per truck of 1,000 lb. estimated for the automatic-electric system. It would be impossible, however, because of this unbalanced traffic, to run more of the cables inbound than outbound, for the reason that the trucks must all return to New Jersey, whether loaded or empty.

The single tunnel for the New York Central would be able to carry 7,200 tons inbound in a 16-hour day, which is considerably in excess of the peak-load requirement of 5,834 tons. The single tunnel for the New York Central would therefore be ample. It would, in fact, be adequate for the New York Central's share of 12,000,000 tons per year, but not of 14,246,000 tons.

Since the capacities of the Manhattan terminals for the automatic-electric system are governed largely by the driveway and tailboard capacities, it can be assumed that the same would be true of the terminals for the cableway system, and that the same number of terminals of about the same size would be required for either system.

Comparative Costs of Construction

There would probably be no great difference in the costs of construction of the cableway and automatic-electric systems, ignoring the fact that the latter system has a capacity of 14,246,000 tons per year everywhere except in its Manhattan terminals, while the cableway system would be limited to 10,000,000 tons in its Hudson River tunnels.

New Jersey Yards and Belt Line — The New Jersey belt line and the Lackawanna and Erie interchange yards would be almost identical in either plan. The design for the joint yard for the cableway system would probably be quite different from that evolved for the automatic-electric system, but it would probably be little if any cheaper to build. The transfer platforms, which constitute a large part of the cost, would be about equally expensive in either case. The electric viaducts of the automatic-electric system would be offset by the complex double-decked viaducts to carry the cableways over the railroad tracks. There would be some saving in track, an item, however, which in its entirety amounts to less than $3,000,000.

Hudson River Tunnels — The four 21-ft. Hudson River tunnels for the automatic-electric system will cost $31,373,900, it is estimated. Four 29-ft. tunnels for the cableway system would cost nearly double that amount, since the costs per foot would vary about as the squares of the diameters. Consequently the four larger tunnels would probably cost nearly $60,000,000 or at least $28,000,000 more than the four for the automatic-electric system.

Manhattan Tunnels — The estimated cost of the Manhattan tunnels of the automatic-electric system is $59,518,425. This figure embraces a double-track line (24-ft. tunnel) throughout except at the terminals, where it would widen to two three-track lines. In the cableway system we would have a main track consisting of a six-line (29-ft.) tunnel considerably more than a third of the distance from the Sixtieth Street yard to Battery Park, then a four-line tunnel and finally a two-line tunnel, in addition to which there would be twenty-four single-line loops to the terminals. Approximate calculations indicate that these tunnels would cost at least $40,000,000, leaving a balance of not to exceed $20,000,000 in favor of the cableway system.

Manhattan Terminals — Driveway and tailboard capacities largely determine the tonnage capacities of the Manhattan terminals for every plan studied by the Commission. The terminals in the automatic-electric system, it is believed, reduce the ground area and so the first cost per ton of capacity to as near a minimum as is possible. Consequently there can be no saving in cableway terminals to handle the same tonnages.

Power Installation and Equipment — The cableway system would probably have an advantage of several million dollars in the cost of power installation as compared with the automatic-electric system. On the other hand there appears to be an equal advantage in the way of equipment in favor of the automatic-electric plan. This is due chiefly to the high cost of the trucks for the cableway system, with their guide wheels and attachments for engaging the cables. Such trucks would cost at least $225 each, it is estimated, and 55,000 of them would be required, whereas 30,000 trailers at $35 each will suffice for the automatic-electric system. The difference in money of $11,325,000 is far more than enough to pay for the automatic-electric cars and the tractors, and nearly if not quite enough to offset the advantage in power installation accruing to the cableway plan.

In short, liberality to the cableway plan gives it perhaps $20,000,000 advantage in the Manhattan tunnels, $2,500,000 in the joint yard and $2,500,000 in power installation and an equipment combined, against which appears $28,000,000 in Hudson River tunnels. This gives the automatic-electric system an advantage of perhaps $3,000,000 exclusive of interest during construction, which, other things being equal, could be ignored.

OPERATING COSTS

In the matter of operating costs the Commission feels that the advantage would be with the automatic-electric system. Labor costs are, it is believed, reduced nearly to an absolute minimum by the automatic features of that electric system. In the case of the cableway system considerably more labor would be required to handle the trucks at the Manhattan stations and at the New Jersey and Sixtieth Street yards. At the New Jersey transfer station in particular it is believed that a large labor force would be required.

There would also be a heavy maintenance item due to the rapid wear of the cables. The Commission believes that a detailed analysis would show that the operating costs of the cableway system would prove to be considerably in excess of that of the automatic-electric system.

OTHER LIMITATIONS

In two other respects the cableway system is thought much less desirable for the problem in hand than the automatic-electric system. One of these is the impossibility of handling standard freight cars through the system; the other is the limiting of the load to what can be moved on a single truck. These limitations preclude the moving of perishable food through to destination without breaking bulk, and bar from the system pianos, cast-iron pipe and other bulky commodities which can be handled on the automatic--electric cars without the trailers, or on standard equipment cars.

CONCLUSION

Credit is due the company consulted for the ingenuity of its devices for making the trucks engage the cable and follow it, for selective switching of the trucks to the desired tunnels and terminals and for the means of moving the trucks up and down inclines and around curves. Although the Commission knows of no cableway installation of the magnitude of that proposed here, it sees no reason why it should not be mechanically feasible. It happens that for the particular problem in hand the automatic-electric system better meets the requirements, on the basis of operating cost, capacity and flexibility for wider use. The Commission is therefore unable to recommend the adoption of the cableway system.

CHAPTER 14

The Plan Recommended — Automatic-Electric System

I — GENERAL

Despite the impracticability of linking the New Jersey railroads to Manhattan to permit locomotives to bring ordinary freight cars to stations in the interior of the island, freight can be brought economically from New Jersey to such stations on cars running on standard-gage tracks. This statement is seemingly paradoxical. The key to the situation is the conversion of the railroad into what is closely akin to a conveyor system. In the system recommended by the Commission, which it designates the automatic-electric system, the special truck-bearing cars will flow in virtually uniform streams, always forward, stopping only long enough to receive and discharge their loads. The great saving in the switching facilities and operations and in the size of terminals and the great gain in capacity make the plan economically sound by a wide margin.

In its efforts to utilize the principle of the moving platform or the conveyor the Commission's representatives conferred with representatives of large companies engaged in the manufacture of such devices. It became apparent that getting freight on and off a continuously moving platform or conveyor would present insurmountable difficulties. Two of the companies, however, were in substantial accord as to a means of applying the conveyor principle, and the plan recommended was worked out in collaboration with their representatives.

There is much resemblance in their general features between the initial development of the automatic-electric plan and the rejected plan for a subway for ordinary freight cars hauled by electric locomotives. Each forms a loop from a joint yard on the Hackensack Meadows, running by tunnel under the Hudson River, passing down the West Side of Manhattan and returning to New Jersey by another set of tunnels. Each has a series of terminal stations in New York. Each has a spur connection with the New York Central, and a belt line connecting the New Jersey roads. The chief advantages of the automatic-electric plan, from the economic standpoint, are the reduced size of terminals, the reduction in Manhattan trackage, the reduced cost per foot of the deep tunnels, and the low operating cost due to automatic operation. The first cost of the plant is so low, as compared with that of a standard marginal railroad, that the 1914 tonnage would nearly carry it, while the excess capacity is so great and the traffic is growing so rapidly that by the time the system could be installed the tonnage would absorb the interest charges with considerable to spare. Thereafter the advantage of the new system would increase yearly, and the heavy terminal burden against New York's railroad freight would be reduced to reasonable proportions.

General Basis of Operation

The general basis of operation of the recommended plan is as follows: Cars containing incoming freight will be placed at platforms in the joint New Jersey yard (New York Central cars at the Sixtieth Street yard) and unloaded upon small trailer trucks that can if desired enter the cars. Partly by hand and partly by electric tractors, the loaded trailers will be run across the platform and into the special automatic-electric cars. The latter will be despatched in eight-car trains through the north tunnel and switched into any terminal desired. Here the trailers will be hauled off, other trailers bearing outbound freight will replace them, and the automatic-electric cars will be despatched in eight-car trains through the south tunnel back to the joint yard, where they will discharge their loads of trailers and begin a new cycle.

The essential characteristic of the system is the automatic operation of the trains at uniform speed, with a minimum of manual control. From yard to terminal and from terminal back to yard the trains will run at a moderate speed without operators. At the terminals and in the yards the cars will run singly, at low speed, with such manual control as is necessary to avoid collision or fouling at switches.

In Manhattan the system will be far underground to avoid conflict with other present and future subways. The special cars, with their trailers, will be handled by elevators between the track level and platform levels accessible to street trucks.

Tonnages to Be Carried

While the studies for a marginal railroad proved that such a railroad could scarcely handle the 1914 peak-load tonnages of the West Side with continuous 24-hour operation, preliminary analysis of the automatic-electric plan showed that it had no such sharp limitations. It was evident both that as large a tonnage as possible should be brought into the plan to share the burden of the first cost, and that any commendable plan must make provision for the future as well as for the present.

The broadest plan, the Commission realized, would embrace the New York, New Haven & Hartford and the Long Island railroads, which have terminals only on the East River and so were not taken into account in the studies for a standard railroad on the West Side; but the inclusion of these roads involved considerable extra expense, and it was not felt that the economic justification of the automatic-electric system for the other railroads should depend on its ability to absorb that extra expense. The Commission subsequently found that the inclusion of these two railroads was justified, and they are included in the recommended comprehensive plan; but the detailed analysis of the system that follows excludes them and their ton-

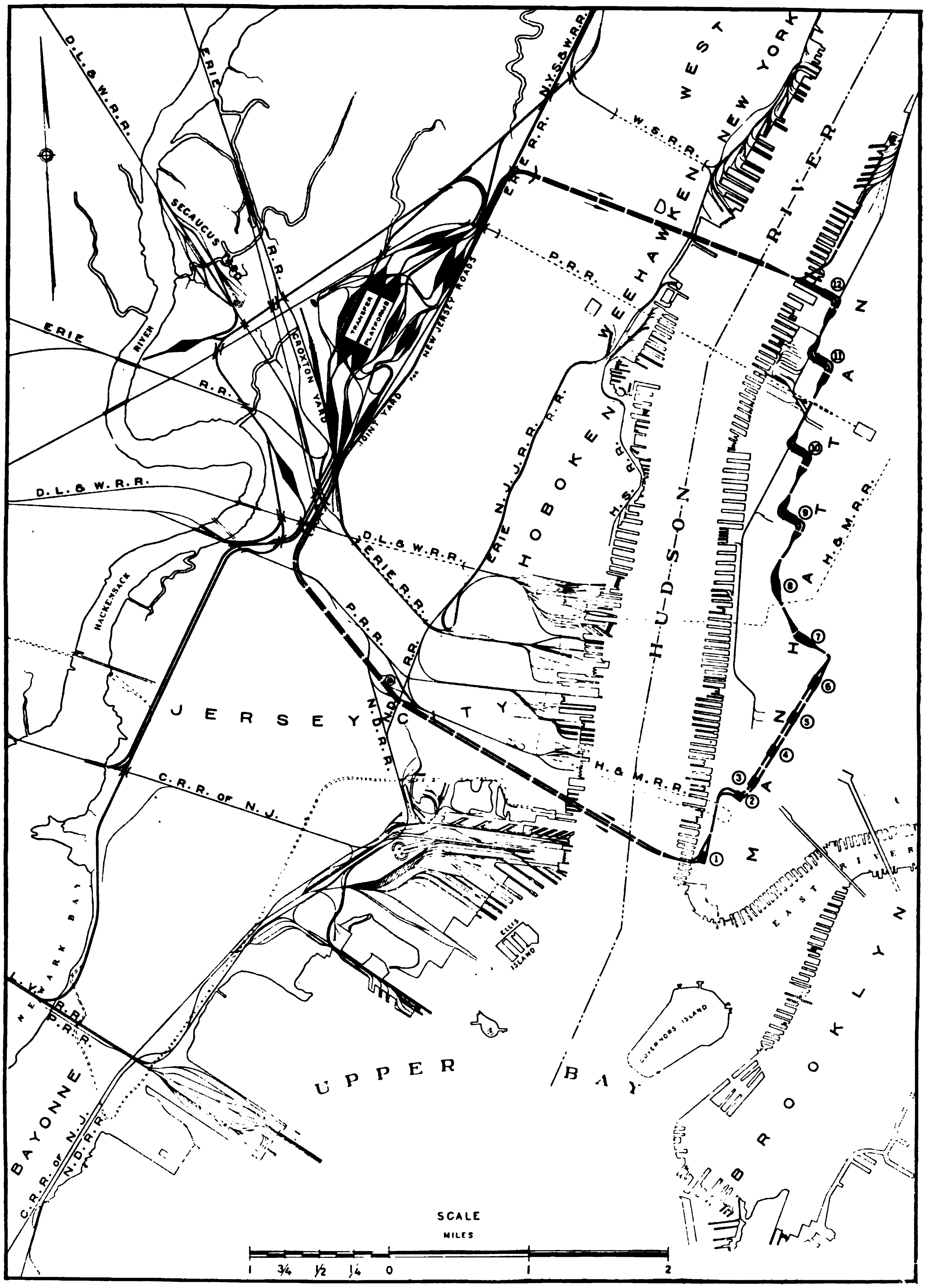


Fig. 1 — Map Showing General Location of Initial Development of Automatic-Electric System — Basis for Economic Proof

nages. The part of the system thus analyzed in detail is referred to in Part I of this report as the initial development, and is shown in outline in Fig. 1 of this chapter. It is designed for the traffic of the New Jersey roads and the New York Central at both the West Side and East Side stations, projected forward to the basis of expected tonnages in 1929.

Unlike the standard marginal railroad, over the main tracks of which the cars to and from the inland float-bridge terminals on the West Side above Twenty-third Street would be hauled, the automatic-electric plant will have nothing to do with the bulky freight of these inland terminals, which it is estimated constitutes 40 per cent of their tonnage, and which must be handled by car floats to and from the waterfront yards of the respective railroads. The remaining 60 per cent, which is now handled in the freight houses of these inland terminals, will, it is assumed, be handled by the automatic-electric system.

Table 1 shows the 1905 and 1919 tonnages it is believed the automatic-electric system would have handled. The Commission's study of the tonnages for all of these years, outlined in Chapter 6, page 154 shows the general trend of the traffic, and the trend curve of Fig. 18 of that chapter gives as reliable an indication as is obtainable of the tonnages to be expected in 1924 and 1929. To use conservative round numbers, it is assumed that the automatic-electric system will be called upon to handle 9,000,000 tons in 1924 and 10,000,000 tons in 1929.

Table 1 — Tonnages the Automatic-Electric System Would Have Had to Handle in 1905 and 1919

	1905	1919*	Increase
Pier stations	4,146,795	5,621,325	1,474,530
Inland stations †	1,497,741	2,242,519	744,778
All stations	5,644,536	7,863,854	2,219,308

* Estimated figures included for last three months; actual figures not available when study was made.

† All of St. Johns Park tonnage included; 60 per cent of that of other inland stations.

The ratio of inbound traffic to outbound is about 60 to 40. Therefore we may assume that in 1929 the total yearly traffic will be 6,000,000 tons inbound and 4,000,000 tons outbound; that the corresponding normal daily loads of 20,000 tons inbound and 13,333 tons outbound will be expanded 75 per cent on peak days, to 35,000 tons inbound and 23,333 tons outbound; and that of these quantities 3,334 tons inbound and 2,222 tons outbound on normal days, and 5,834 inbound and 3,889 outbound on peak days, will be New York Central tonnage, and the remaining tonnages of 16,666, 11,111, 29,166 and 19,444 respectively will be those of the New Jersey roads. In 1924, the earliest year in which the system could be put into operation, the various figures will be 10 per cent less than those given for 1929.

II — DESIGN AND OPERATION OF SYSTEM

Inasmuch as the system recommended represents a radical departure from anything now found in New York, or in fact in any port, it will perhaps be well to describe the general method of operation more fully than was done on page 251, and then return to the details.

Electric Fundamentals of System

The basic electrical features of the system are the provision of (1) operation at moderate speed of the trains between the yards and the terminals, (2) low-speed man-controlled operation in the yards and in the terminals, and (3) means of effecting the transition from one form of operation to the other.

The first requisite involved the determination of a speed sufficient to move the freight in a reasonable time the several miles between yards and terminals, and the provision of "trailing dead sections" behind each train to eliminate the possibility of collision. The speed adopted as satisfactory from the viewpoint of despatch in moving the freight and also from that of the electric characteristics is 1,200 ft. per min. or about 13.6 miles per hour. This speed compares favorably with that of the average freight train, and will bring a car from yard to terminal in from 15 to 30 minutes. The trailing dead section is explained on page 271.

For the low speed 200 ft. per min. or about 2.27 miles per hour was adopted as slow enough to permit men to start and stop the cars from the ground or platform without mounting the cars, and to minimize the damage from collision without choking the system.

Transition between the higher-speed automatic movement of the cars in trains and the low-speed manually controlled movement of single cars will be accomplished by means of special accelerating and retarding or decelerating sections of track about one and one-half train lengths long, such tracks to be side tracks connected with the main tracks. The throwing of a switch will start a train on an accelerating track and it will automatically speed up to 1,200 ft. per min. before leaving the section and entering the main track. When it arrives at one of the yards or the terminal for which it is intended the throwing of a switch will turn it from the main track, and it will be automatically brought to a standstill on a decelerating section after it has cleared the main track. At the same time the individual cars of these trains can be operated at will under manual control at the low speed anywhere on the accelerating or decelerating section.

On the basis of these three fundamental electrical requirements, it was determined that there should be two main tracks throughout the system, the two operating in the same direction and forming two parallel loops. Each main track will have its independent connection with each terminal. Under peak-load conditions there would theoretically be a train on each track every 3.29 min., assuming that the system would operate sixteen hours to accommodate such peak loads. In actual operation the minimum spacing will be less than this because of the necessity for operating the New Jersey trains in fleets and inserting the New York Central trains between fleets, as is explained on pages 268–270.

Manhattan Terminals

Any number of terminals could be built and connected with the system up to the point where their combined capacity equaled that of the New Jersey and Sixtieth Street transfer yards and the remainder of the track system. The number of terminals contemplated is such that they will accommodate the expected normal 1929 tonnage inbound and outbound in a 10-hour day, while the extreme peak loads can be taken care of in 16-hour days. The design of the individual terminals is such that the capacities of the driveways, tailboard space and car elevators are nearly the same, so that there will be little waste capacity at any point.

DRIVEWAY AND TAILBOARD CAPACITIES

To arrive at the driveway and tailboard capacities, some of the same assumptions were used as in the studies for the elevated and underground marginal railroads for standard equipment. It was assumed, for example, that the driveways would have sawtooth faces to permit trucks to back in readily without obstructing much of the driveways, and that the driveways alongside the platforms should be wide enough for four lines of moving trucks with trucks standing at the tailboard spaces. It was estimated as the result of a detailed study that through such a driveway in one of the subway terminals, where there would be no conflicting currents of traffic at the entrances and exits, 120 trucks per hour could pass, and the same figure has been used in this analysis, inasmuch as conflicting currents can also be avoided here.

Other assumptions similar to those previously used are truck loadings of two tons and one ton respectively for inbound and outbound freight, and a rate of loading or unloading at the tailboards of 12.5 min. per ton — these figures having been derived from the clockings made by the Commission's field forces.

The terminals as laid out naturally vary somewhat to fit the street blocks on which they are placed, but the average or typical terminal has forty-eight tailboard spaces for trucks calling for inbound freight and thirty-six for trucks bringing outbound freight. Using these numbers and the other assumptions previously referred to, the hourly capacity of the twelve terminals, as far as the driveways and tailboard spaces are concerned, is 2,764.8 tons for inbound freight and 1,440 tons for outbound freight.

In the case of the inbound freight it is the tailboard capacity that governs, the result being derived by the product of the number of terminals, number of tailboard spaces per terminal, number of tons per truck and number of trucks that can load in one tailboard space in an hour, or $12 \times 48 \times 2 \times 60/25 = 2{,}764.8$. In the case of outbound freight it is not the tailboard capacity but the driveway capacity which controls, the figure being the product of the number of terminals, number of trucks per hour that can be moved through the driveways and number of tons per truck, or $12 \times 120 \times 1 = 1{,}440$.

Determination of the complementary capacity figures — driveway capacity inbound and tailboard capacity outbound — would show the former figure to be 2,880 tons (double the outbound because of double truck loads) and the latter to be 2,073.6 tons. The inbound driveway and tailboard capacities are nearly the same, showing little waste capacity. There is seemingly considerable disparity in the outbound capacities, but it is probable that the average outbound truck loads would be considerably increased under the improved conditions of the new terminals, in which case the disparity would be greatly reduced. Such a change would increase the driveway capacity without affecting the tailboard capacity, inasmuch as the calculations are based on the theory that there would be trucks at each tailboard space at all times, so that there could be continuous unloading, whether from one or more trucks.

Using the limiting capacities of 2,764.8 and 1,440 tons per hour inbound and outbound respectively, the twelve terminals, as far as the driveways and tailboard spaces are concerned, could handle 27,648 tons and 14,440 tons outbound in a 10-hour day, or 44,236.8 tons inbound and 23,040 tons outbound in a 16-hour day. When these figures are compared with the expected 1929 tonnages of 20,000, 13,333, 35,000 and 23,333 respectively, the desirability of increasing the outbound truck loads is apparent, and inasmuch as their average is so small in comparison with the physical capacity of the average truck, the Commission deems it proper to take account of this in the design, and so avoid excess capacity for outbound freight.

At peak hours of peak days, as determined by tests at the railroad pier stations, the inbound freight increases about 34 per cent and the outbound 55 per cent. Overtime at the terminals will care for this, as there are only one or two peak hours, but it is thought that there is sufficient margin of safety in the hourly rate to take care of these by speeding up the operations.

ARRANGEMENT OF DRIVEWAYS AND PLATFORMS IN TERMINALS

Congestion on adjacent streets is likely to be caused by 258 trucks per hour at one terminal, even though the capacities of the driveways themselves are ample, unless conflicting movements can be avoided. Complete separation of inbound and outbound trucks is effected in the layout evolved, a layout which at the same time conserves terminal space by providing two levels of driveway floors.

The terminals will be placed virtually astride the streets that feed them. The design of a typical terminal and the directions of traffic movement are shown in Fig. 2. Inbound freight will use the platforms and driveways at the street level, while outbound freight will use those underneath. Inbound and outbound trucks will enter the terminals at the center at opposite ends, will pass through it without conflict, and upon departing will turn away to right or left, still without conflict and still at opposite ends of the terminal.

Specifically, trucks bringing outbound freight will approach from the north or west on a street on the axis of the terminal, and enter a central driveway in the terminal descending to the level of the outbound floor, reaching that level at the opposite end of the terminal. Here they will double back to the right or left on level driveways alongside the unloading platforms, and back in to their respective tailboard spaces. After unloading they will proceed north or west as the case may be, turn around the end of the

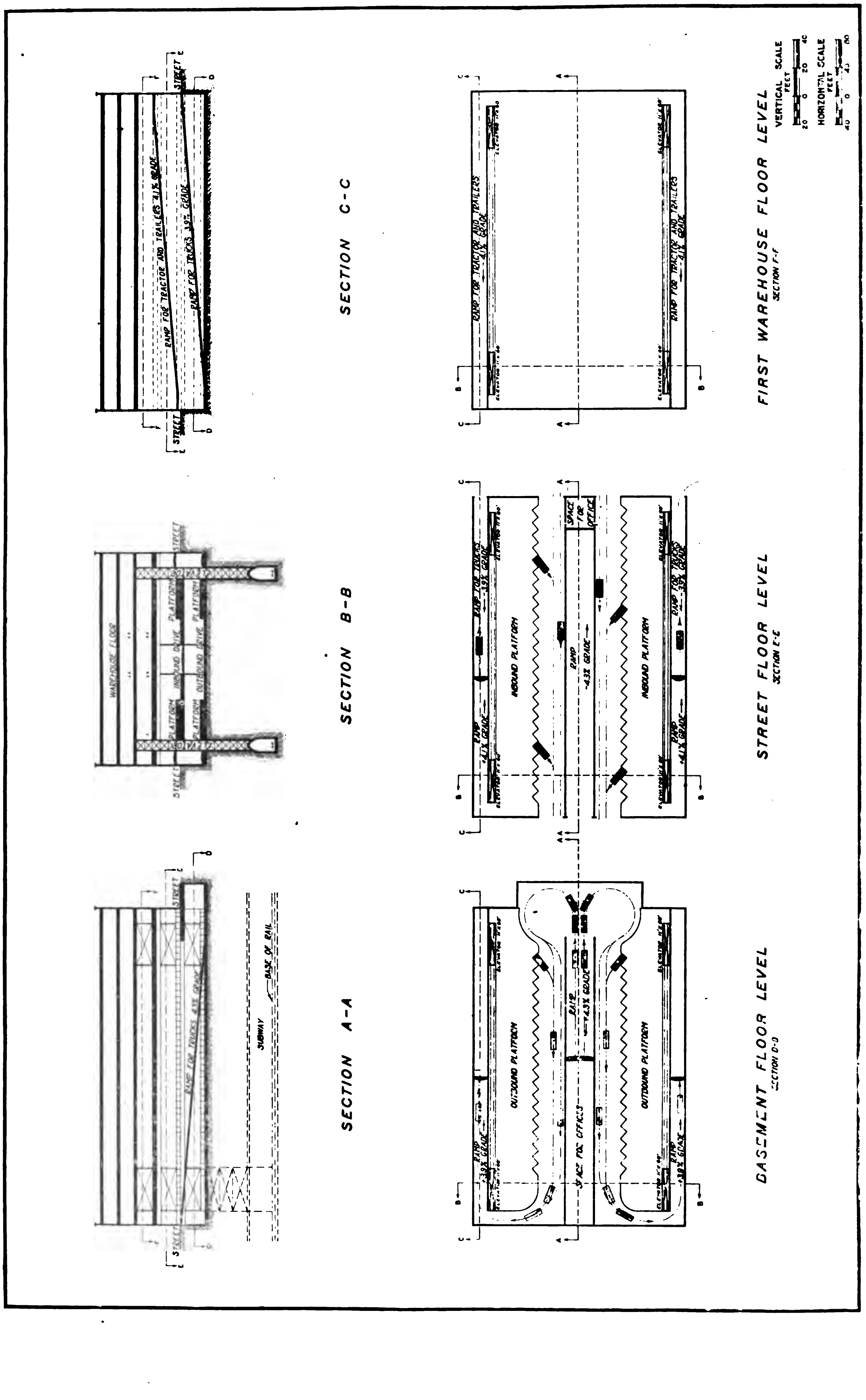


Fig. 2 — Details of Typical Station for Automatic-Electric System — Plans of Three Floors of Terminal Proper, and Transverse and Longitudinal Sections (Main-line tunnels not shown)

platform and ascend in the original direction on ramps still within the building but along its outer edges. Emerging from the terminal, the trucks on the right side will turn to the right and those on the left to the left, and immediately leave the terminal.

Trucks coming for inbound freight will approach from the opposite end of the terminal, on the same street along the axis of the terminal. Arrived at the terminal, the drivers will have to get their papers and learn whether their freight is in the right or left half of the terminal. Having done this they will proceed on one of the two street-level driveways, which are separated by the descending ramp for trucks bringing outbound freight. They will obtain their loads by backing to the proper tailboard spaces, and will then continue in the same direction to points of departure just to the right and left respectively of the incoming stream of trucks bringing freight. They will turn away from this stream and pass out of the terminal region by way of the cross streets without encountering any other trucks except the normal traffic on adjoining streets.

It will be noted that the trucks handling inbound freight will remain always at street level, while those handling outbound freight at the lower level will make the descent loaded and the ascent empty. The system will necessitate special traffic regulations for the several streets adjacent to the ends of each terminal.

The outbound platforms will be vertically under the inbound, and of the same over-all width, 60 ft. They will necessarily be shorter because of the driveways running around their ends.

Above the street level, for receiving and temporarily storing overflow inbound freight, for handling bulky freight to and from the automatic-electric cars, and for other purposes, will be a third platform level, reached by ramps over those at the sides of the terminal building. On this level the two halves of the terminal will be connected over the intervening driveways, making a single large floor.

The dimensions of the average terminal will be about 450 ft. along the axis and 302 ft. across. Fig. 3 is a drawing of a typical terminal in full operation.

ARRANGEMENT OF ELEVATORS

At one end of and alongside this second-story platform on each side of the terminal there will be a well for a 12 × 60-ft. car elevator running down to the terminal track level, passing alongside the main inbound and outbound platforms underneath. At the other end in a corresponding position will run another car elevator of the same size on each side of the building, but connecting only the three platform floors. The two kinds of elevators will be referred to as the main elevators and the shuttle elevators. Each elevator will carry a longitudinal track of standard gage, and the elevator wells at each level will be connected by sections of track 280 ft. long or so, depending on the length of the terminal, and depressed to bring the car floors level with the platforms.

The main elevator will bring up one of the automatic-electric cars loaded with trailers to the street level or the floor above. The car will be run off upon the short section of track, the trailers will be hauled off at some point along the platform, trailers previously unloaded will be run upon the car and the car will be run upon the shuttle elevator, which will take it down to the outbound floor. Again the car will run off upon the short section of track at this level, and while the shuttle elevator returns to one of the floors above for another car, the empty trailers will be run off to receive new loads and other trailers already loaded with outbound freight will be run upon the car, after which it will proceed to the main elevator and be lowered to the track level.

It is proposed to place the track system far enough below the ground surface to allow two subways, one above the other, to pass over it, which means 80 ft. or so below ground. This will be reduced considerably at the terminals by the 2-per cent approach grades explained later. The distance between adjoining floors in the terminals will be about 17 feet. Therefore in computing the elevator cycles it is assumed that measuring from the track level it will be 57 ft. to the outbound floor, 74 ft. to the middle or main inbound floor and 91 ft. to the top floor, while it will be 34 ft. from the top floor to the bottom or outbound floor.

ELEVATOR CAPACITY OF TERMINALS

The elevators, which will be electrically operated and provided with leveling devices explained later, are designed for a speed of 100 ft. per minute. The main elevator governs the elevator capacity of the half-terminal, inasmuch as if it can be kept moving at all times except when cars are going on or off, the shuttle elevator can easily keep pace with it, and the moving of the cars between elevators and of the trailers on and off the cars can be taken care of, as will be later explained.

Making due allowances for the time required for opening and closing gates, moving cars on and off the elevators and accelerating and decelerating the elevators, the cycle of the main elevator will be approximately 230 sec. under the most unfavorable conditions, namely, when the elevator goes the 91 ft. to the top floor to discharge its inbound car, descends 34 ft. to the bottom floor to receive an outbound car and then descends the remaining 57 feet.

Each round trip of each main elevator will bring to the half-terminal a car bearing twelve trailers loaded with inbound freight, and take away another car bearing trailers partly or wholly loaded with outbound freight. In one hour, with the cycle of 230 sec., the elevator will move 15.6 cars in each direction. In the more common operation, when the elevators run to the street-level floor only, the length of the cycle will be reduced to about 210 sec., and 17 cars can be handled each way in an hour.

Observations made in the railroad clockings indicate that an average load of 1,250 lb. per trailer can be assumed for inbound freight. With twelve trailers per car the average load per car will be 7½ tons. Therefore the hourly capacity of the half-terminal is 117.9 tons in each direction, that of the full terminal is double this figure and that of the twelve terminals is 2,829.6 tons, as compared with driveway and tailboard capacities of 2,764.8 tons inbound and 1,440 tons outbound.

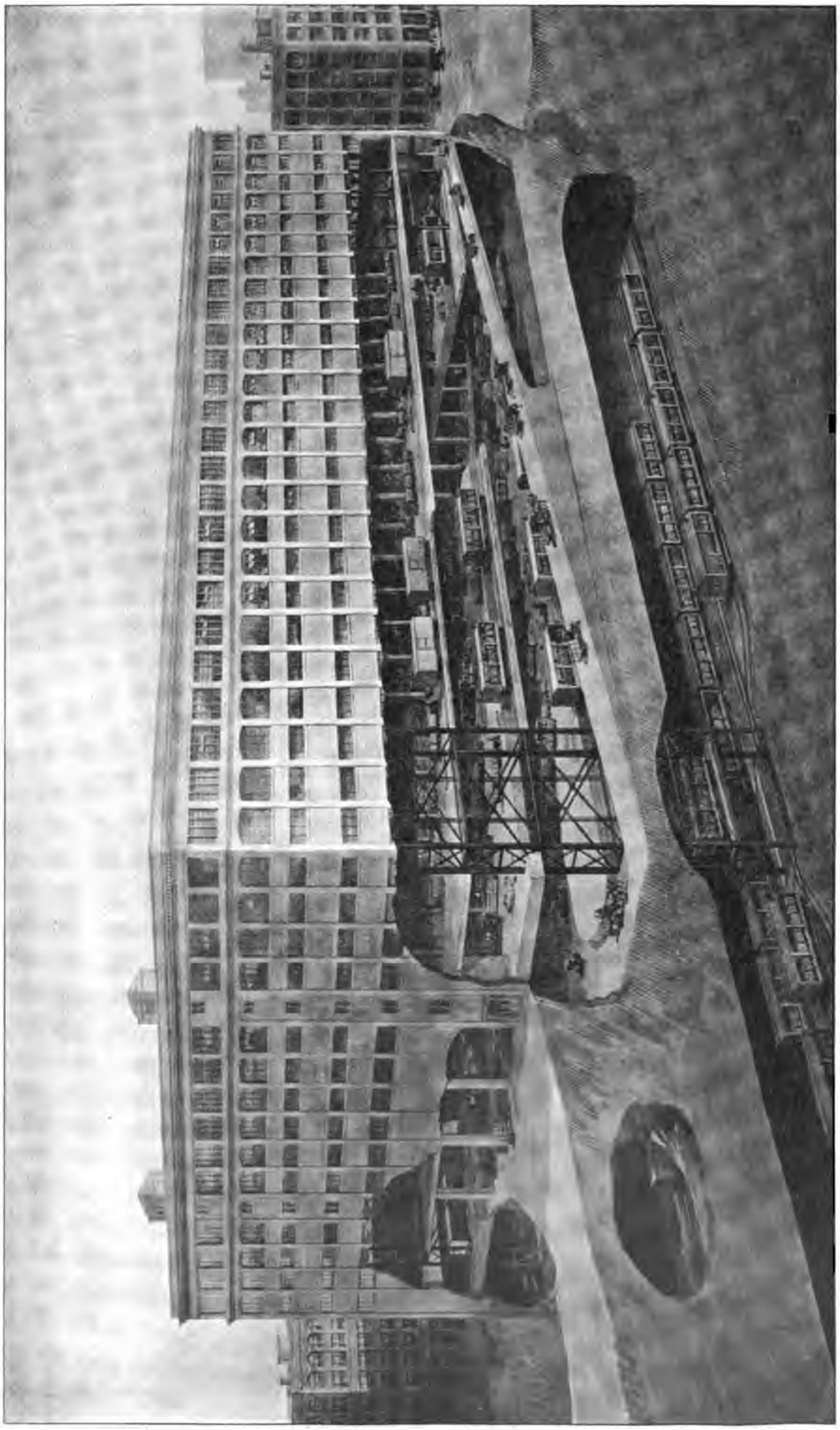


Fig. 3 — Sketch of Typical Automatic-Electric Terminal, Showing Elevators, Cars, Drays and Trailer Trucks in Operation at the Various Levels

The observations referred to show a smaller loading for outbound trailers, the average not exceeding 1,000 lb. While the trailers of course have the same physical capacity in each direction, the fact that only 40 per cent on the average of the total tonnage to be handled is outbound makes it likely that the average loading outbound will be less. Using the figure of 1,000 lb. and the tonnage ratio of 60 to 40, we find that about 8 trailers in every 32 will return empty to New Jersey or Sixtieth Street. The elevators can take outbound freight away faster than the trucks can bring it.

ELEVATOR AND CAR SCHEDULE

Operation of the cars at the platform level to synchronize with the elevator movements, avoid loss of time to the main elevators and still provide a liberal amount of time for getting the trailer on and off the cars will be somewhat complex. Fig. 4 is a diagram showing both elevator and car cycles. It is assumed that the tracks on both main working floors in the terminals are kept full of cars, which means four cars on each track, since the cars are 58 ft. long. Each car will stand 13.35 min. on the inbound floor and the same period on the outbound floor, or 26.7 min. in all, and on each floor it will have to occupy each of four positions, standing 3.34 min. in each position, all cars on a floor moving forward simultaneously, or nearly so, a car length as the head car runs upon one elevator and another car runs off the other elevator.

For example, Car 1 will stand at position *D* of the diagram for 3.34 min., and equal periods respectively at positions *E, F* and *G.* After being lowered to the outbound floor, it will stand 3.34 min. at *J* and the same period successively at *K, L* and *M.* The shuttle elevator, though capable of a cycle of 88.43 sec., will be held after each trip to harmonize with the movement of the main elevator. Inbound trailers can be hauled off the cars within the 3.34 min. at any one of the four positions, *D, E, F* or *G,* and the same allowance of time will be given for putting outbound trailers on at *J, K, L* or *M.* It is estimated that it will require only 3 min. to put the trailers on or off, so that the time is ample. The periods given are those for peak loads. With less traffic, more time will be available.

TRACK ARRANGEMENT AT TERMINALS

Leading to each main elevator well from the main track on the corresponding side of the terminal will be two approach or receiving tracks spreading from a single turnout in the main track, and coming together again in front of the elevator, as shown in Fig. 8, Part IV. These tracks will serve the double purpose of providing space for incoming trains to decelerate and come to rest entirely clear of the main track, and of furnishing standing room for the cars until they can go one by one via the elevator to the street level.

To aid in the deceleration the tracks after the main-line turnout is passed will rise on a 2-per cent grade. The combination of this adverse grade and electric braking at the rate of 1 ft. per sec., will bring the train to rest in about 124 ft. The minimum working length of the receiving tracks, from clearance at the main track to clearance between the two receiving tracks in front of the elevator, will be about 630 ft., 124 ft. plus the length of an eight-car train plus an allowance of about 42 ft. as a margin of safety.

Each train as it leaves the transfer yard will bear a conspicuous sign indicating the terminal for which it is destined, and a switchman at the approach to the terminal will throw it to either of the receiving tracks.

From the receiving tracks the cars will run singly under manual control, but without riders, at a speed of 200 ft. per min., to the elevator, and cars brought down by the elevator will proceed similarly to the advance tracks until they accumulate in an eight-car train. A signal interlocked with the main-track system will indicate when the train can enter the main track, and the throwing of a switch will start the train. The exact counterpart of the approach tracks will lead from the elevator to the main track, with a 2-per cent descending grade to aid the acceleration of the train, and when the starting switch is thrown the train will automatically speed up to 1,200 ft. per min. before entering the main track, and proceed without further attention to the New Jersey yard.

There must be two receiving tracks and two forwarding tracks for each elevator to take care of irregularities in the cycle of operation. Under peak loads the elevators must run continuously with part trains standing on the receiving and forwarding tracks most of the time, and without some reservoir space the terminals would easily clog.

ADDITIONAL FLOORS FOR OTHER USES

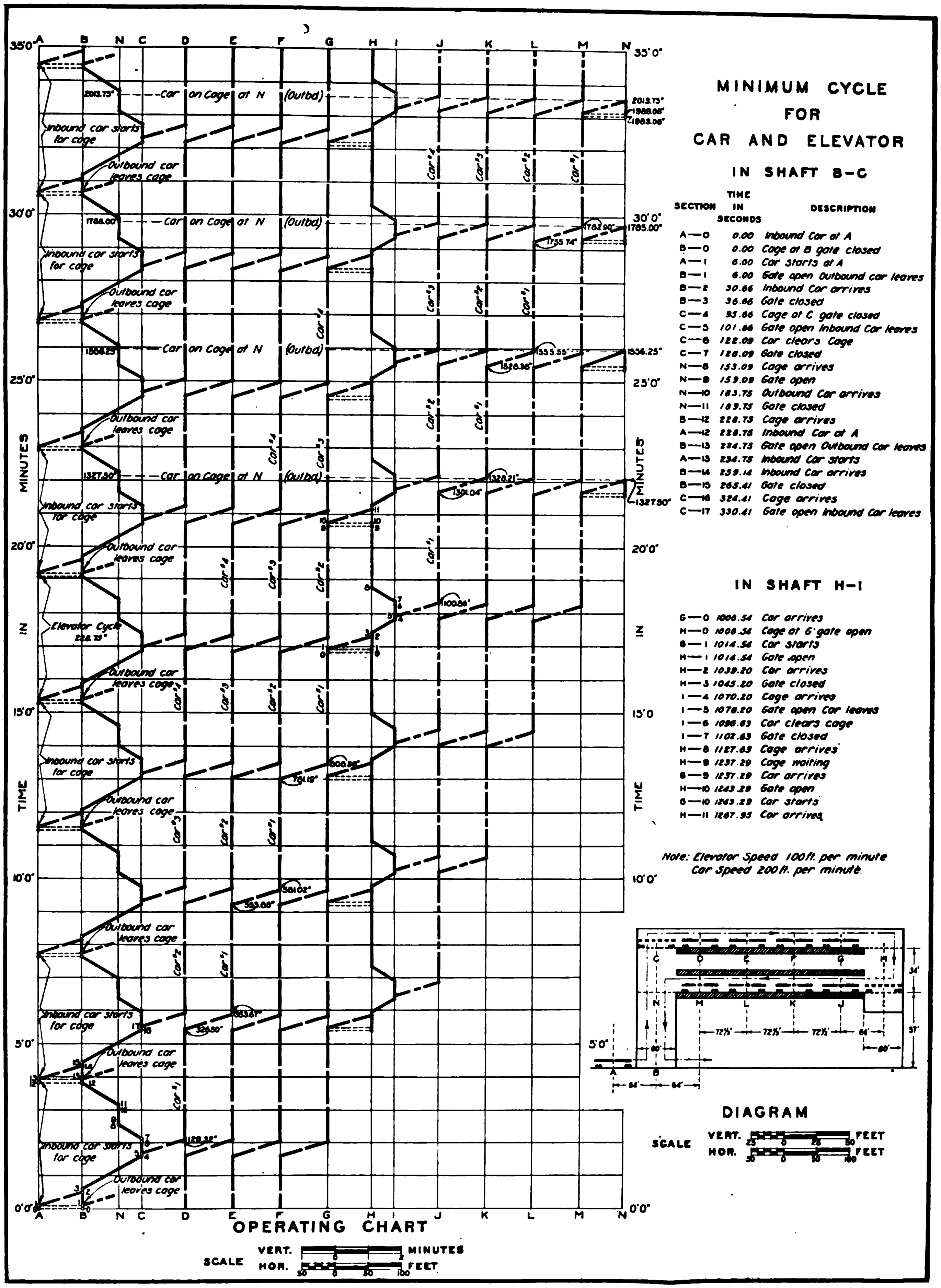
Ordinarily the terminal operations will require only partial use of the floor above the main inbound floor, and it is expected that half of this floor will be available for general warehouse purposes.

The terminals are designed with two more floors to be rented for warehouse purposes. The additional trucking such floors will occasion will be small compared with the total traffic of the terminal, and can be accommodated without difficulty. Such floors will give the terminals four stories each above ground, with a fifth floor below ground.

The discussion of operating costs, beginning on page 273, takes cognizance of the possibility of building one or two additional floors and renting them for manufacturing or office purposes at a much higher unit rate than can be obtained from warehouse floors. Such locations, accessible to all of the railroads using the automatic-electric system without the necessity for trucking, should prove very attractive.

FOOD DISTRIBUTION AND EXPRESS BUSINESS

Some of these terminals may be materially modified to conform to the improved food-distribution system recommended by the Commission and discussed in detail in Chapter 20. The possibilities are various — ordinary terminals receiving both foodstuffs and general freight, terminals definitely assigned to market purposes and laid out accordingly, auxiliary market terminals adjacent to the general terminals and con-



MINIMUM CYCLE FOR CAR AND ELEVATOR

IN SHAFT B-C

SECTION	TIME IN SECONDS	DESCRIPTION
A—0	0.00	Inbound Car at A
B—0	0.00	Cage at B gate closed
A—1	6.00	Car starts at A
B—1	6.00	Gate open Outbound car leaves
B—2	30.66	Inbound Car arrives
B—3	36.66	Gate closed
C—4	95.66	Cage at C gate closed
C—5	101.66	Gate open Inbound Car leaves
C—6	122.09	Car clears Cage
C—7	128.09	Gate closed
N—8	153.09	Cage arrives
N—9	159.09	Gate open
N—10	183.75	Outbound Car arrives
N—11	189.75	Gate closed
B—12	228.75	Cage arrives
A—12	228.75	Inbound Car at A
B—13	234.75	Gate open Outbound Car leaves
A—13	234.75	Inbound Car starts
B—14	259.14	Inbound Car arrives
B—15	265.41	Gate closed
C—16	324.41	Cage arrives
C—17	330.41	Gate open Inbound Car leaves

IN SHAFT H-I

G—0	1008.54	Car arrives
H—0	1008.54	Cage at G gate open
G—1	1014.54	Car starts
H—1	1014.54	Gate open
H—2	1039.20	Car arrives
H—3	1045.20	Gate closed
I—4	1070.20	Cage arrives
I—5	1076.20	Gate open Car leaves
I—6	1096.63	Car clears cage
I—7	1102.63	Gate closed
H—8	1127.63	Cage arrives
H—9	1237.29	Cage waiting
G—9	1237.29	Car arrives
H—10	1243.29	Gate open
G—10	1243.29	Car starts
H—11	1267.95	Car arrives

Note: Elevator Speed 100 ft. per minute
Car Speed 200 ft. per minute.

Fig. 4 — Graphical Analysis of Car and Elevator Cycles at Typical Automatic-Electric Terminal During Peak Load

nected thereto by trucking galleries, or private terminals with direct automatic-electric car service during the off hours of operation. All of the possibilities are matters for careful future study.

The system is also well adapted to the handling of express. At present the express companies are poorly equipped in the way of terminals to serve the public in a satisfactory manner. Their few stations with direct rail connections are overworked and congested and the stations without such direct connections are basically uneconomic, adding greatly to street and ferry congestion and subjecting the public to delay and damage to or loss of its goods. An express station at each automatic-electric terminal would make possible a much improved express service.

New Jersey Joint Yard

There will be three principal elements in the New Jersey joint yard: A steam section for standard railroad equipment, an electric section for the automatic-electric cars, and a series of platforms for the transfer of freight by trailer or otherwise between the two kinds of cars. Standard freight cars handled by yard locomotives will be put through the steam section from north to south without back-up movement, first discharging their freight and then reloading, while the automatic-electric cars will pass through in the opposite direction, also without back-up movement. Grade crossings of steam and electric tracks will be avoided by the elevation of the electric tracks at the crossing points beyond the ends of the platforms.

Fig. 5 shows a general plan of the proposed yard.

STEAM SECTION

The steam section of the yard will have three main units — a group of inbound receiving yards, a transfer-platform unit and a group of outbound forwarding yards — in addition to which there will be miscellaneous facilities incidental to most large railroad yards. A feature of the operation of this section, made possible by the functioning of the electric section, will be the elimination of inbound classification of the standard cars.

Inbound Receiving Yards — The receiving yards for inbound freight will consist of two units, each having a capacity of 600 cars; each unit being divided into two halves and each half containing twelve tracks with

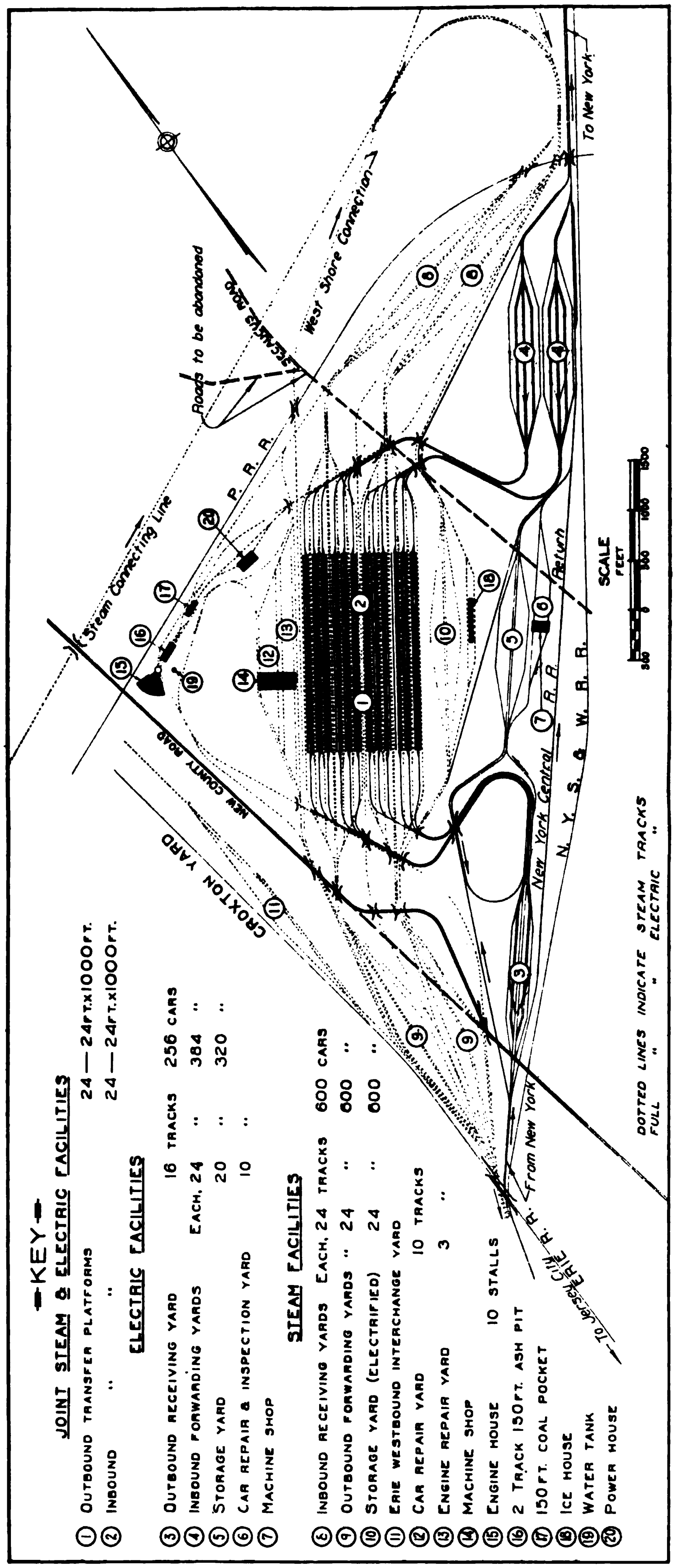

To New York
West Shore Connection
Roads to be abandoned
P. R. R.
Steam Connecting Line
Return
New York Central R. R.
N. Y. S. & W. R. R.
CROXTON YARD
NEW COUNTY ROAD
From New York
To Jersey City
ERIE R. R.
SCALE
FEET
500
0
500
1000
1500
DOTTED LINES INDICATE STEAM TRACKS
FULL " " ELECTRIC "
—KEY—
JOINT STEAM & ELECTRIC FACILITIES
① OUTBOUND TRANSFER PLATFORMS 24 — 24 FT. x 1000 FT.
② INBOUND " 24 — 24 FT. x 1000 FT.
ELECTRIC FACILITIES
③ OUTBOUND RECEIVING YARD 16 TRACKS 256 CARS
④ INBOUND FORWARDING YARDS EACH, 24 " 384 "
⑤ STORAGE YARD 20 " 320 "
⑥ CAR REPAIR & INSPECTION YARD 10 "
⑦ MACHINE SHOP
STEAM FACILITIES
⑧ INBOUND RECEIVING YARDS EACH, 24 TRACKS 600 CARS
⑨ OUTBOUND FORWARDING YARDS " 24 " 600 "
⑩ STORAGE YARD (ELECTRIFIED) 24 " 600 "
⑪ ERIE WESTBOUND INTERCHANGE YARD
⑫ CAR REPAIR YARD 10 TRACKS
⑬ ENGINE REPAIR YARD 3 "
⑭ MACHINE SHOP
⑮ ENGINE HOUSE 10 STALLS
⑯ 2 TRACK 150 FT. ASH PIT
⑰ 150 FT. COAL POCKET
⑱ ICE HOUSE
⑲ WATER TANK
⑳ POWER HOUSE

Fig. 5 — General Plan of Steam and Electric Yard in New Jersey for Joint Use of New Jersey Railroads and Automatic-Electric System

a capacity of twenty-five cars each, corresponding with the capacity of a platform track 1,000 ft. long. As there will be twenty-four platform tracks, the receiving yards, with a total of forty-eight tracks, will have just double the capacity of the inbound section of the steam transfer-platform tracks.

Subject to readjustment to suit variations in the relative traffic of the different railroads, the tracks of these yard units have been assigned to the different railroads in proportion to their traffic. Beginning at the westerly side of the yard, the first four tracks of the first group of twelve are assigned to the West Shore Railroad and the remaining eight to the Erie. Of the next group, six are assigned to the Lackawanna and six to the Pennsylvania. Ten of the third group give the Pennsylvania a total of sixteen. The remaining two of that group and six of the fourth group are assigned jointly to the Central Railroad of New Jersey and the Baltimore & Ohio, while the remaining six tracks go to the Lehigh Valley.

On the basis of 10,000,000 tons of freight per annum, with a peak-load factor of 1.75 (75-per cent expansion), these yards provide 6.6 hours storage.

Transfer-Platform Tracks — Leads from these units spread to the transfer-platform tracks. These tracks will be twenty-four in number (for the steam section), and will have a platform length of 2,000 ft., 1,000 ft. inbound and 1,000 ft. outbound. The total capacity will therefore be 1,200 cars. The arrangement will be set forth more fully in conjunction with that of the electric tracks under the general heading of "Transfer Platforms."

Outbound Forwarding Yards — There will be two outbound forwarding yards, each divided into two halves. The number and length of tracks, total car capacity, storage capacity and assignment by railroads will be the same as for the inbound receiving yards.

Miscellaneous Facilities — Miscellaneous facilities in the steam section will include a storage yard with twenty-four tracks and 600 cars capacity; an icing station; an engine terminal with a house of ten stalls, ash pits, coal trestle and water tanks; a car-repair yard of ten tracks; an engine-repair yard of three tracks, and a machine shop.

ELECTRIC SECTION

The electric section of the yard will also consist of three main units — an outbound receiving yard, transfer-platform tracks and inbound forwarding yards — in addition to which there will be miscellaneous facilities within the yard proper, enumerated later, and bypass tracks alongside the yard for New York Central outbound trains. The automatic-electric cars will have to be classified twice, once to reach the proper platforms for discharging their outbound loads, and once after receiving inbound loads to be made into trains for the proper terminals. The interchangeability of the automatic-electric cars, however, will eliminate the necessity for placing certain cars to receive certain loads, and the electric operation as well as the steam operation will be much simpler than ordinary steam-yard operation.

Receiving Yard — The receiving yard for cars containing outbound freight will consist of sixteen tracks with a capacity of sixteen cars or two trains per track, or 256 cars in all, in addition to the space required beyond clearance points for bringing the train automatically to rest from full speed.

Ordinarily all trailers loaded on one automatic-electric car at a Manhattan terminal will be for one railroad, but it will not be feasible to despatch the cars in solid trains for one railroad (except in the case of the New York Central, where this will have to be done), and the average train will contain cars for several railroads. Consequently there can be no assignments of the tracks in the receiving yard, and the cars must be classified between that yard and the transfer platforms.

Lead Tracks for Outbound Classification — Four tracks with "scissors" crossovers, arranged in the manner shown on Fig. 6, will be necessary to effect the placing of the cars at the proper transfer platforms. These tracks will lead from the receiving yard, and as there will be one platform track to correspond with each platform track in the steam section of the yard, or twenty-four automatic-electric platform tracks in all, each lead track must fan out to six platform tracks.

These lead tracks will be elevated and carried over the steam tracks leading to the transfer platforms.

Transfer-Platform Tracks — The transfer-platform tracks of the electric section will be the counterpart of those of the steam section — the same in number and length. They are discussed more fully under the heading of "Transfer Platforms," on the next page.

Forwarding Yards — The forwarding yards will consist of two units, each containing twenty-four tracks and having a capacity of sixteen cars or two trains per track besides the necessary distance to allow for acceleration from rest to a speed of 1,200 ft. per minute. Each unit will be divided into halves of 12 tracks each, and one track will be assigned in each half-unit to each of the twelve Manhattan terminals. The yards will thus have a total storage capacity of 768 cars. The reason so much more storage is given in the forwarding yards than in the receiving yard is that any accumulation of inbound automatic-electric cars will probably have to be taken care of in the forwarding yards, while any accumulation of outbound cars will be more likely to occur on the New York side of the Hudson River.

Four lead tracks, each running from six transfer-platform tracks, will bring the cars to the yard units. From any one of these tracks the cars can be classified directly to a track for any Manhattan terminal. The lead tracks will be elevated and carried over the steam tracks leading from the transfer platforms.

New York Central Runaround Tracks — New York Central freight will be transferred between standard cars and automatic-electric cars at its Sixtieth Street yard. To avoid the construction of an additional return track in Manhattan it is proposed to carry the New York Central outbound freight around the loop through New Jersey. It would be desirable if New York Central freight could be treated at the terminal stations like that of the other roads and sent out in trains with cars for the other roads, to be separated out in the

New Jersey yard. This, however, it was found on analysis, would greatly complicate the operation of the yard and make necessary the provision of much additional trackage. It was concluded, therefore, that New York Central cars would have to be held at the individual stations and despatched in solid trains to the entrance to the New Jersey yard, where they would be bypassed, coming back upon the main line at the outlet to the yard.

In order to facilitate the operations of feeding these New York Central trains into the current inward from the yard, a complex problem of despatching discussed on pages 268–270, a second track is provided near the north end of the bypass track. Another is provided at the south end as a reservoir for New York Central trains diverted from the main current.

TRANSFER PLATFORMS

The transfer station proper will consist of twenty-four covered platforms 2,000 ft. long and 24 ft. wide. They will be spaced far enough apart to admit two tracks between adjacent platforms, and elevated to the height of a car floor. These pairs of tracks will be alternately steam and electric tracks, so that each platform will have a steam track on one side and an electric track on the other side, while the pairing of the tracks will simplify the arrangement of switches.

The platforms will be assigned to the different railroads on the basis of proportional tonnage, each railroad having half as many platforms as inbound steam receiving tracks. In other words, beginning at the west, two platforms will be assigned to the West Shore, four to the Erie, three to the Lackawanna, eight to the Pennsylvania, four jointly to the Central of New Jersey and the Baltimore & Ohio, and three to the Lehigh Valley.

An imaginary line across the layout will divide it into a 1,000-ft. inbound section and a 1,000-ft. outbound section. The inbound section will be at the north end. In it inbound freight will be unloaded from standard cars upon trailers, which will be run upon empty automatic-electric cars. At the outbound end the same automatic-electric cars will have discharged trailers loaded with outbound freight, while the same steam cars will receive similar trailers loaded with outbound freight.

While it is expected that automatic-electric cars will be loaded at the Manhattan terminals for only one railroad, it still becomes necessary to get the freight on those cars to any or all of the platforms in the New Jersey transfer station assigned to that particular railroad. In the case of the Pennsylvania there are eight such platforms. There may also be emergencies in which one automatic-electric car will be loaded with freight for several railroads, and it will be well to have all platforms accessible from all other platforms. This could be accomplished through the freight cars, but that is not desirable. Provision is made for "jack-knife" bridges from platform to platform — bridges that can be drawn up or lowered at will. It may, however, prove preferable to substitute overhead bridges for the jack-knife bridges.

The transfer station will have a total capacity of 600 steam cars inbound and 600 outbound. The overall dimensions of the station will be about 2,000 x 1,140 ft., this including the space for an engine thoroughfare track through the center of the station.

The foregoing takes no account of the double-decking of a part of the transfer station suggested in Chapter 20, page 340, to provide a receiving station for perishable foodstuffs as part of the recommended improved system of food distribution. The system requires a receiving station connected with the automatic-electric system. The logical location for it seems to be over part of the transfer station.

OPERATION OF YARD AS A WHOLE

Considering now the operation of the yard as a whole, we find that the steam and electric sections will function in harmony and with a simplicity that will go far toward eliminating the extra cost of breaking bulk on the freight.

Steam Section — Steam trains will enter the receiving yards from the north, all except the West Shore trains passing around the loop at that end. The haul engines bringing them can proceed from the receiving yards to the engine terminal, or if it is not necessary for them to go to the engine terminal they can pass direct to the outbound forwarding yards via the thoroughfare track through the center of the transfer station, and be at once available for taking a train out. The receiving yards are large enough so that half of the tracks will be available for incoming trains while the other half are being worked to the transfer platforms.

Yard engines will take the cars and by flat switching classify them according to the loads they are to receive outbound. For example, a car that is to be loaded with freight for Pittsburgh and despatched via the Pennsylvania, irrespective of the destination of its inbound load, will be placed on the track alongside the platform from which the Pennsylvania loads cars for Pittsburgh. The car will merely be stopped at the north or inbound section of the platform so that its contents can be transferred to trailers, and then it will be pushed forward to the point at which it is to receive its outbound load.

During periods of heavy traffic it will doubtless be impossible to do much classifying between the receiving yards and the platforms. At such time the cars will probably have to be pushed into the transfer station in solid strings, and those that are not to be reloaded for the road that brought them in will be returned empty to the break-up yards, whether or not they are destined for one of the other local railroads.

Full carloads for the more important stations can be made up at the transfer platforms. The limited time and space available will preclude the holding of cars any considerable period for full loads for the stations of lesser importance, or the loading of less-than-carload freight in station order. On the other hand, the fact that the outbound freight is concentrated at one transfer station instead of being scattered among three or more stations for each railroad will probably make it possible to make up minimum carloads for more minor points than at present. A small percentage of outbound less-than-carload freight is rehandled at present at the break-up yards, and more is loaded into trap cars at the pier stations and carried through to some division point on the line, to be rehandled there. There will doubtless have to be a certain amount of second rehandling under the proposed system at the break-up yards to consolidate Manhattan package freight with that from other parts of the Port, but the total number of trap cars despatched requiring rehandling somewhere along the line will probably be materially decreased.

When the standard cars have received their outbound loads they will be pulled by yard engines to the forwarding tracks, where with little additional switching they can be despatched to the various roads as required. Haul engines will have direct access to the forward end of these yards from the engine terminal. West Shore trains will loop back from the yard; other trains will proceed direct along the proposed belt line.

It is not believed that the steam operations present any obstacles materially different from those overcome at every large yard.

This section of the yard has been referred to as the steam section. It is likely, however, that in the course of time electric power will supplant steam not only in this yard but throughout the Port District. This probability is set forth on page 25 of Part I.

Electric Section—Meanwhile the electric cars bringing outbound freight from Manhattan in eight-car trains will enter the receiving yard at the south end and be automatically decelerated and brought to rest. From this point through manual control the cars will be run singly at 200 ft. per min. out of the receiving yard and through the crossover system which will divert them to whichever of the four lead tracks connect with the platforms upon which they are to discharge their loads. As soon as they pass the crossovers they will be automatically accelerated to 600 ft. per min., slowing down again to 200 ft. per min. when they reach the transfer platforms.

At the proper points in the south or outbound half of the transfer station they will be stopped, either by an operator or by a tripping device, and will discharge their loaded trailers. They will then, still by manual control, be moved forward to the north or inbound half of the station, where they will receive loads for any of the twelve terminals, each car receiving freight for only one terminal. They will be started once more by manual control and accelerated to 200 ft. per min., which speed they will maintain until they leave the platforms, when they will be automatically accelerated to 600 ft. per min. Reaching the throats of the forwarding yards, they will again be automatically slowed down to 200 ft. per min. and will be switched to the forwarding tracks of the proper terminals. As each of the four leads from the transfer platforms has a yard track for each terminal, there will be no crossing or fouling of traffic in this operation.

While the cars moving singly within the yard are under manual control, the speed of 200 ft. per min. or about 2.3 miles per hour at all points where there are switches to be thrown or where cars are likely to be started or stopped is so low that no rider need accompany the cars, and they can be handled by men standing or walking alongside them.

Platform Operations—Although the standard cars must necessarily remain at the platforms a considerable length of time to discharge their loads and receive new ones, this is not the case with the automatic-electric cars. It was estimated in the study of the Manhattan terminals that such a car can be unloaded or loaded in three minutes. The arrangement recommended here makes the automatic-electric cars on any transfer track nearly 6 min. apart under peak-load conditions, and gives each car a minimum of well over an hour of standing time at each half of the transfer station. This will tend to minimize the long-distance trucking that might be expected from platform units 1,000 ft. long. Automatic-electric cars bringing outbound freight can in many instances be stopped opposite the cars that are to receive the greater part of their freight, so that the average haul of the loaded trailers will perhaps not exceed 250 feet.

The inbound section of each platform will be subdivided into twelve sections, one for each terminal, and usually an empty automatic-electric car can be placed central to each section. The steam cars will probably have to be placed without much regard to the terminals for which their loads are destined, but the hauls will probably not average more than 250 feet.

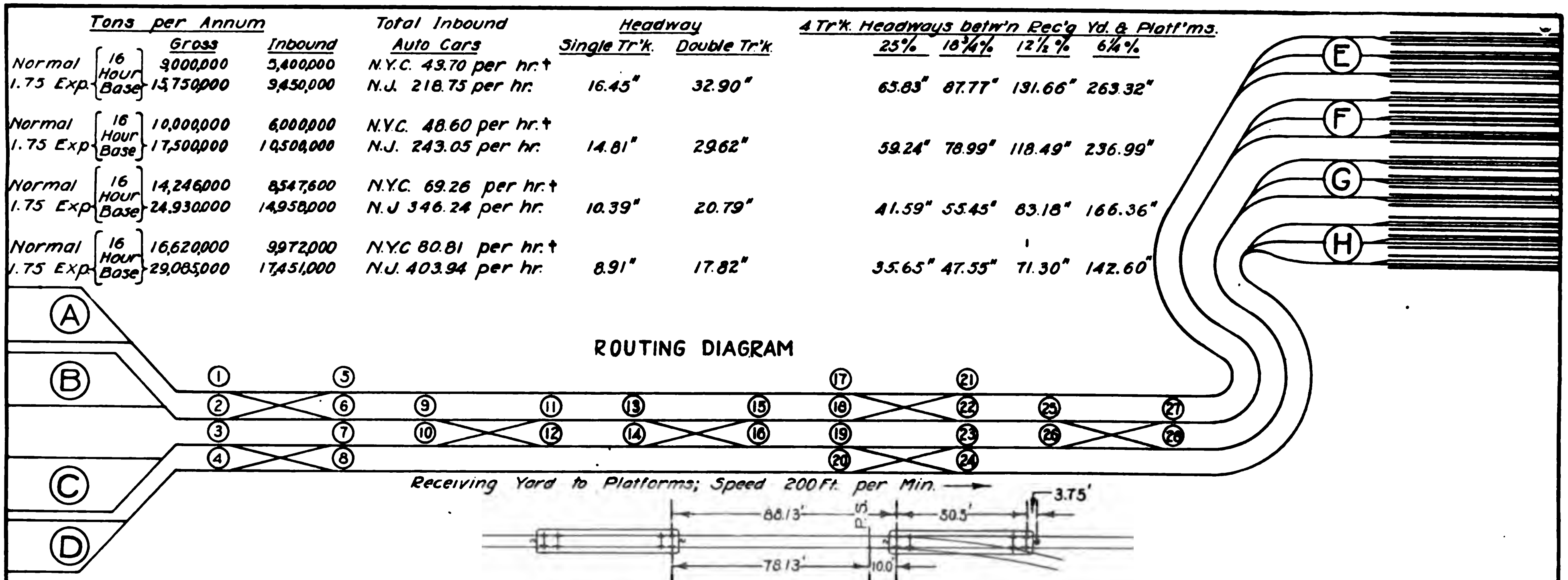
Trailers that have discharged their outbound freight into steam cars will be drawn empty by tractors along the platforms to the inbound section to receive new loads.

OPERATING CAPACITY OF ELECTRIC SECTION OF YARD

Analysis of the capacity of the main tracks, which determines the ultimate capacity of the system for the reason that the tracks cannot easily be expanded after once built, indicates, as developed later, that 14,246,000 tons per annum may be conservatively considered the safe limiting capacity of the system, although certain improvements might conceivably increase that figure to 16,620,000 tons. It is highly desirable that the capacity of the yard be equal to that of the main-line system.

Since the inbound tonnage preponderates, in the ratio of 60 to 40, this is the tonnage the system must be able to accommodate; and the maximum load comes on peak days, when an excess tonnage of 75 per cent over normal is met by an increase of the operating period of only 60 per cent, from 10 to 16 hours. The peak-load tonnage on the 14,246,000-ton basis is equivalent to 24,930,000 tons per year, of which 14,958,000 tons is inbound. The New York Central tonnage, constituting about a sixth of the total, will not pass through the yard, and the peak-load New Jersey tonnage on the 16-hour basis will be reduced to 346.24 automatic-electric cars per hour. With four running tracks between the yard units, this means a headway on each track of 41.59 seconds. Between the transfer station and the forwarding yards, where there are no crossovers and it is necessary merely to switch each car direct to its proper track in the forwarding yard, this headway is ample. Between the receiving yard and the transfer station it was necessary to make a careful analysis of the operations, for the reason that cars must be able to pass from any one of the sixteen

		Tons per Annum		Total Inbound	Headway		4 Tr'k. Headways betw'n Rec'g Yd. & Platf'ms.			
		Gross	Inbound	Auto Cars	Single Tr'k.	Double Tr'k.	25%	18¾%	12½%	6¼%
Normal	16 Hour Base	9,000,000	5,400,000	N.Y.C. 43.70 per hr.†						
1.75 Exp.		15,750,000	9,450,000	N.J. 218.75 per hr.	16.45"	32.90"	65.83"	87.77"	131.66"	263.32"
Normal	16 Hour Base	10,000,000	6,000,000	N.Y.C. 48.60 per hr.†						
1.75 Exp.		17,500,000	10,500,000	N.J. 243.05 per hr.	14.81"	29.62"	59.24"	78.99"	118.49"	236.99"
Normal	16 Hour Base	14,246,000	8,547,600	N.Y.C. 69.26 per hr.†						
1.75 Exp.		24,930,000	14,958,000	N.J 346.24 per hr.	10.39"	20.79"	41.59"	55.45"	83.18"	166.36"
Normal	16 Hour Base	16,620,000	9,972,000	N.Y.C 80.81 per hr.†						
1.75 Exp.		29,085,000	17,451,000	N.J. 403.94 per hr.	8.91"	17.82"	35.65"	47.55"	71.30"	142.60"


ROUTING DIAGRAM

Receiving Yard to Platforms; Speed 200 Ft. per Min. →

Routes for Single Cars, Yard to Platforms.

A — 1 — 5 — 17 — 21 — E
A — 1 — 5 — 17 — 22 — 25 — 27 — F
A — 1 — 6 — 9 — 11 — 13 — 15 — 18 — 22 — 25 — 28 — G
A — 1 — 6 — 9 — 11 — 13 — 16 — 19 — 24 — H

B — 2 — 5 — 17 — 21 — E
B — 2 — 5 — 17 — 22 — 25 — 27 — F
B — 2 — 6 — 9 — 12 — 14 — 16 — 19 — 23 — 26 — 28 — G
B — 2 — 6 — 9 — 12 — 14 — 16 — 19 — 24 — H

C — 3 — 8 — 20 — 24 — H
C — 3 — 8 — 20 — 23 — 26 — 28 — G
C — 3 — 7 — 10 — 11 — 13 — 15 — 18 — 22 — 25 — 27 — F
C — 3 — 7 — 10 — 11 — 13 — 15 — 18 — 21 — E

D — 4 — 8 — 20 — 24 — H
D — 4 — 8 — 20 — 23 — 26 — 28 — G
D — 4 — 7 — 10 — 12 — 14 — 16 — 19 — 23 — 26 — 27 — F
D — 4 — 7 — 10 — 12 — 14 — 15 — 18 — 21 — E

† N.Y.C. cars do not operate over tracks that are shown on this page.

Percentages and Headways in Seconds of Cars Passing Various Sections of Routing Diagram while being Classified for "Railroads Consigned To"

Section	%	Headway *	Section	%	Headway *	Section	%	Headway *
A — 1	25	59.24"	C — 3	25	59.24"	1 — 6	12½	118.49"
1 — 5	12½	118.49"	3 — 7	12½	118.49"	2 — 5	12½	118.49"
5 — 17	25	59.24"	7 — 10	25	59.24"	17 — 22	12½	118.49"
17 — 21	12½	118.49"	10 — 12	12½	118.49"	18 — 21	12½	118.49"
21 — E	25	59.24"	12 — 14	25	59.24"			
			14 — 16	18¾	78.99"	9 — 12	12½	118.49"
B — 2	25	59.24"	16 — 19	25	59.24"	10 — 11	12½	118.49"
2 — 6	12½	118.49"	19 — 23	12½	118.49"	13 — 16	6¼	236.99"
6 — 9	25	59.24"	23 — 26	18¾	78.99"	14 — 15	6¼	236.99"
9 — 11	12½	118.49"	26 — 28	12½	118.49"	25 — 28	6¼	236.99"
11 — 13	25	59.24"	28 — G	25	59.24"	26 — 27	6¼	236.99"
13 — 15	18¾	78.99"						
15 — 18	25	59.24"	D — 4	25	59.24"	3 — 8	12½	118.49"
18 — 22	12½	118.49"	4 — 8	12½	118.49"	4 — 7	12½	118.49"
22 — 25	18¾	78.99"	8 — 20	25	59.24"	19 — 24	12½	118.49"
25 — 27	12½	118.49"	20 — 24	12½	118.49"	20 — 23	12½	118.49"
27 — F	25	59.24"	24 — H	25	59.24"			

* Headways are shown on basis of 243.05 cars per hour; for other rates in cars per hour see top of page.

Fig. 6 — Operating Analysis of Peak Traffic of Automatic-Electric Cars Between Receiving Yards and Transfer Platforms of Joint Yard in New Jersey

receiving tracks to any one of the twenty-four transfer tracks.

Graphical Analysis—Fig. 6 presents a graphical analysis of this problem. In the center is a track diagram in which the letters A, B, C and D represent groups of four tracks each in the receiving yard and E, F, G and H groups of six tracks each in the transfer station, while the numerals (1) to (28) indicate the positions of the scissors crossovers, of which there will have to be two pairs between the outside tracks and three between the center tracks. In the lower left-hand corner are the routes cars will follow in passing from each of the four receiving-yard groups to each of the four transfer-platform groups, worked out in such a way as to distribute the load on the crossover.

In the upper left-hand corner is a table showing the gross normal annual tonnage, the theoretical expanded annual tonnage corresponding to a peak load of 1.75 times the normal load, the corresponding inbound annual tonnages and the number of inbound New York Central and New Jersey automatic-electric cars required per hour to handle these tonnages. The table is made on four bases, that of the 9,000,000 tons expected in 1924, that of the 10,000,000 tons expected in 1929, that of the 14,246,000 tons estimated at the practical limiting capacity of the main-track system, and that of a fourth figure of 16,620,000 tons which might be obtainable by improved junctions for the New York Central, as will be explained later.

In the same table are columns showing the headways that would be required if all of the tonnage ran over a single track and if all ran over two tracks, and that on each of four tracks for different percentages of the total traffic, corresponding to those shown in the table in the lower right-hand corner of the illustration, using these tracks.

In the lower right-hand corner the headways for the different routes from yard to platforms are traced through, on the basis of 10,000,000 tons per year expanded by the factor 1.75, and the percentage of cars that will run on each track. It shows that no section of track will have to carry more than 25 per cent of the traffic, and that no crossover will have to take more than 12½ per cent. This means that a maximum of 25 per cent of the cars will pass the intersections of crossovers. Thus the physical intervals between cars at these crossings will be about the same as on the straight-track sections of heaviest traffic, if the cars are so manipulated that a car crossing between two others will be spaced midway between them.

Two cars 41.59 sec. apart on one of these sections of straight track of maximum traffic will be 138.63 ft. apart, center to center of car. The distance between end axles of the individual car will be 50.5 ft. Therefore the distance from the rear axle of the front car to the head axle of the car following will be 88.13 ft. In case a switch is to be thrown between the two cars there will be this distance of 88.13 ft. available less 10 ft. of the switch (the length of the movable points) which must be cleared before the switch can be thrown. The remaining distance of 78.13 ft. corresponds to 23.4 sec., the time available for throwing the switch between cars.

Steam Belt Line in New Jersey

A belt line will be required to connect the steam section of the joint yard with each of the New Jersey railroads. This will be located as shown in Fig. 1. It will be a single-track line from a junction with the Lehigh Valley Railroad near Greenville to a junction with the Newark branch of the Central of New Jersey, a double-track line from the latter junction to one with the Pennsylvania at Marion, and from there to its connections with and through the joint New Jersey yard it will be a loop track. Separate single-track connections will be provided for the West Shore.

On the basis of 10,000,000 tons per year and a peak factor of 1.75, the single-track system of the belt line at the south end will carry a train each way every 68.5 min., while on the double-track section the intervals on each track will range from 25.2 south of the Pennsylvania junction to 8.12 min. on the inbound track and 12.42 min. on the outbound track near the yard. Outbound junctions of the West Shore, the Erie and the Lackawanna are provided at the south end of the yard at intervals of about 1,200 ft., which will make it possible on days of maximum business to make the necessary break-up movements. Just south of the westbound junction of the Lackawanna two outbound tracks will begin, and just north of the westbound junction of the West Shore these two will increase to four tracks in order to permit switching operations in the westbound forwarding yards. It is believed that both the steam belt line and steam yard systems will be capable of doing their part in handling an annual traffic of 14,246,000 tons, although on peak days some overtime may be necessary.

Break-up and make-up operations will have to be performed at the existing break-up yards substantially as at present. The belt line as well as the electric system will presumably be operated by a separate terminal company, which will receive cars from and deliver them to the individual roads on interchange tracks at the junction points. The terminal company will have two classes of locomotives—haul engines for the belt-line work and yard engines for the work in the yard.

Route in Manhattan

Because of its great depth underground the line can be carried farther inland in Manhattan than would be feasible with a subway for standard equipment. This will effect a wider separation of the street trucks serving the terminals and those serving the reorganized Hudson River waterfront, and will also bring the system nearer the East River stations whose tonnage is to be included in the plan. Sharper curves can be used than would be practicable in ordinary railroad operations.

The comprehensive plan is not intended to fix the precise location of the line in Manhattan. The route indicated on Fig. 8, Part IV, shows a line with terminals indicated approximately central to twelve zones of equal traffic, on property of not unreasonably high value, but easily accessible, and on streets on which traffic restrictions can be placed without detriment.

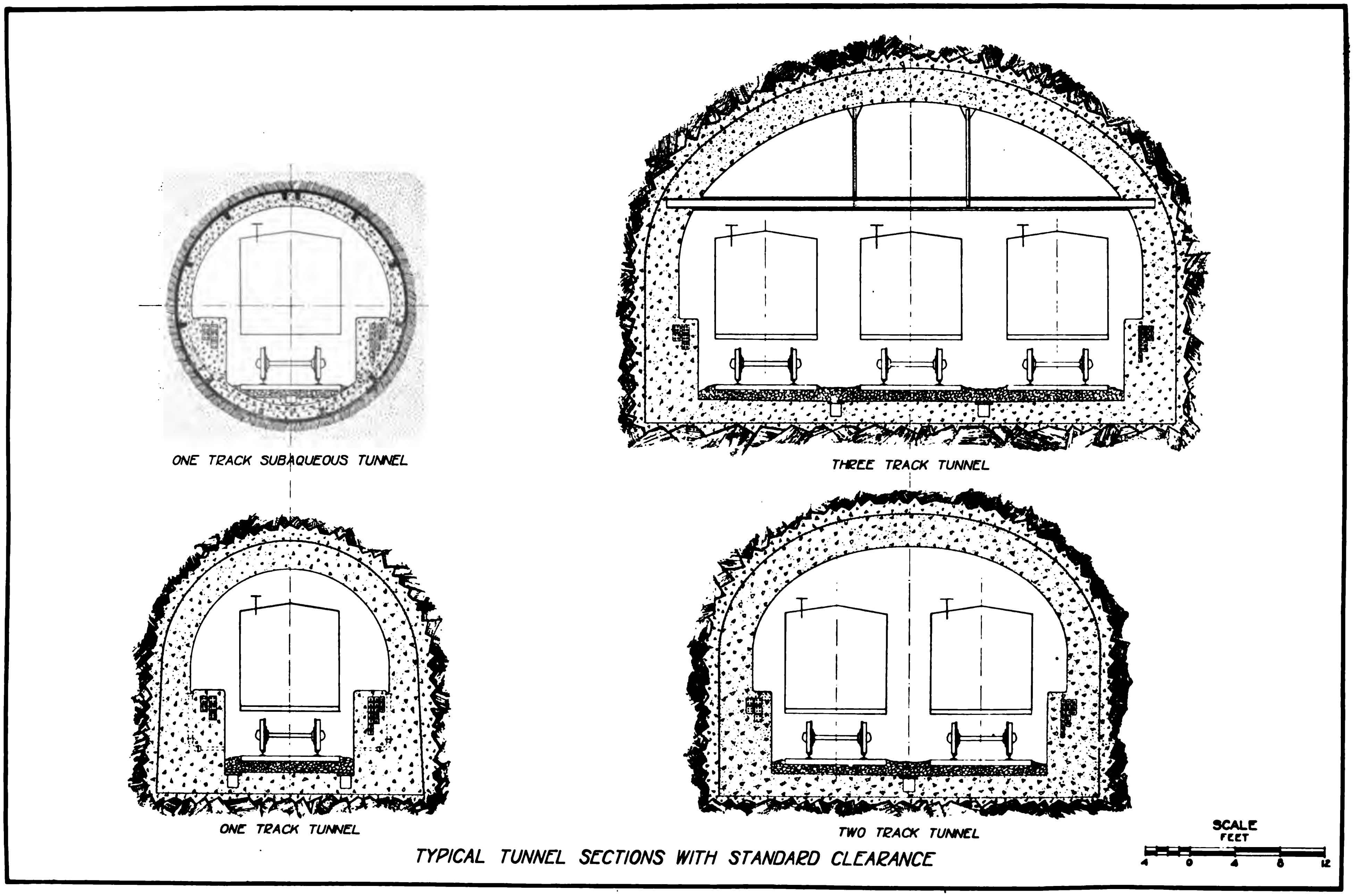
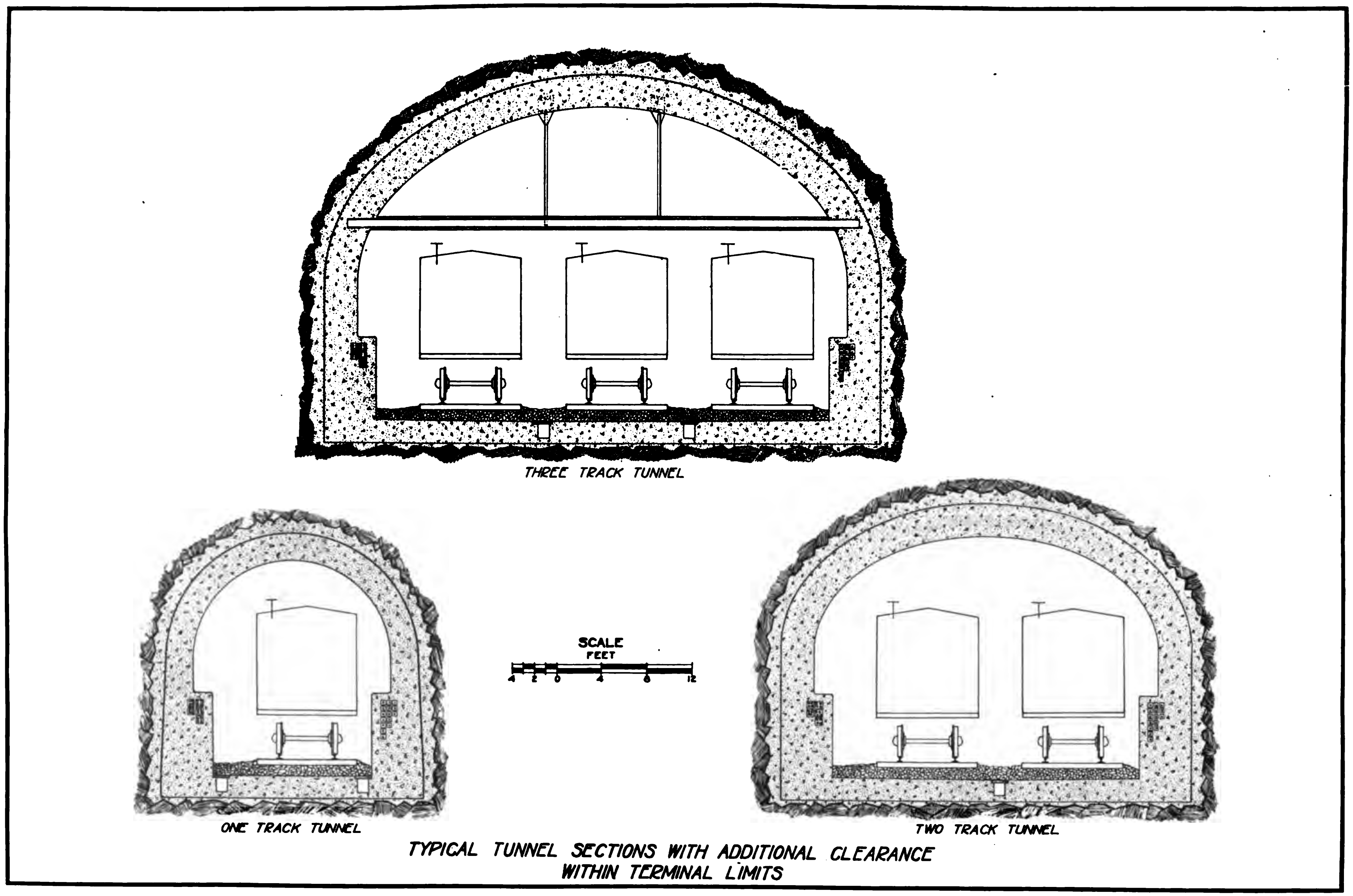

ONE TRACK SUBAQUEOUS TUNNEL
THREE TRACK TUNNEL
ONE TRACK TUNNEL
TWO TRACK TUNNEL
TYPICAL TUNNEL SECTIONS WITH STANDARD CLEARANCE
SCALE
FEET
4
0
4
8
12

Fig. 7 — Details of Typical One-Track, Two-Track and Three-Track Tunnel Sections Outside of Terminal Limits, Automatic-Electric System


THREE TRACK TUNNEL
SCALE
FEET
4
2
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8
12
ONE TRACK TUNNEL
TWO TRACK TUNNEL
TYPICAL TUNNEL SECTIONS WITH ADDITIONAL CLEARANCE WITHIN TERMINAL LIMITS

Fig. 8 — Details of Typical One-Track, Two-Track and Three-Track Tunnel Sections with Additional Clearance Within Terminal Limits

The tunnels under the Hudson River, one at Morris Street and the other at Forty-seventh Street, are placed where there would be a minimum of interference with existing structures. Typical cross-sections of the single-track, double-track and three-track tunnels outside of the terminal district are shown in Fig. 7, and cross-sections within the district, where wider clearance will be required, are shown in Fig. 8.

The total length of the loop system, as shown in Fig. 1, is about 14.3 miles. The length in Manhattan is 5.2 miles. The average distance from the New Jersey yard to the Manhattan terminals is about 7.0 miles and from the terminals back to the yard, 7.3 miles.

New York Central Transfer Yard and Connections

A separate transfer yard and connections will have to be provided for the New York Central. The yard will naturally be built on part of the area occupied by the present Sixtieth Street yard in Manhattan, which will have to be entirely remodelled. It will be similar in a general way to the New Jersey yard, but on a much smaller scale. The Commission has not attempted to evolve a detailed design for it.

A double-track connection 0.7 mile long will reach from this yard to the entrance of the main system into Manhattan at Forty-seventh Street. Incoming trains will use the easterly track and will be held north of the junction point on the main track or on a storage siding provided for the purpose until the coast is clear for the train to enter the current of New Jersey trains. Outbound trains can be diverted from the main system as fast as they arrive at the junction point.

Main-Line Capacity

A necessary feature of the main-line system for safe automatic operation is the trailing dead section of track behind each train. This is explained in detail under the heading of "Electrical Features," page 270. The dead sections will prevent any train from coming within a certain distance of the preceding train, and will therefore impose a definite limit on the main-line capacity of the system. The effective capacity will be further limited by the necessity for getting New York Central trains into and out of the flow of traffic.

The simplest despatching plan would be to operate all of the New Jersey trains on each of the two main tracks at a uniform interval, and interpose the New York Central trains as they were ready in the middle of the intervals. It was found that this could not be done under peak-load conditions, as it would bring the trains too close together and into the dead sections. Consequently it will be necessary to despatch the New Jersey trains in "fleets" of alternately three trains and two trains, with gaps between fleets of double the established interval, so that New York Central trains can be inserted.

GRAPHICAL ANALYSIS

Fig. 9 shows an operating diagram of the main-track system. The arrows indicate the direction of operation, and show that incoming New York Central trains will come upon the main system at (8), will be detoured around the yard at (23), coming back upon the main tracks at (3), and will leave the system at (6). Half of the incoming New York Central trains can readily be diverted to the right-hand main track by the crossover 10–7, and the main tracks from that crossover to the point (24) will carry equal loads. The section 8–10 on the left-hand track must, however, carry all of the New York Central traffic as well as half of the New Jersey, and the same is true of the sections 21–23 and 3–5 on the right-hand track. Under these circumstances there is no advantage in distributing the outbound New York Central trains between the two tracks in the north tunnel—leading from the points (4) and (5)—and it will be simpler to divert them all to the left-hand track by the crossover 5–4. These four sections, therefore, are the limiting sections of the main-line system. Each must carry half of the New Jersey traffic and all of the New York Central.

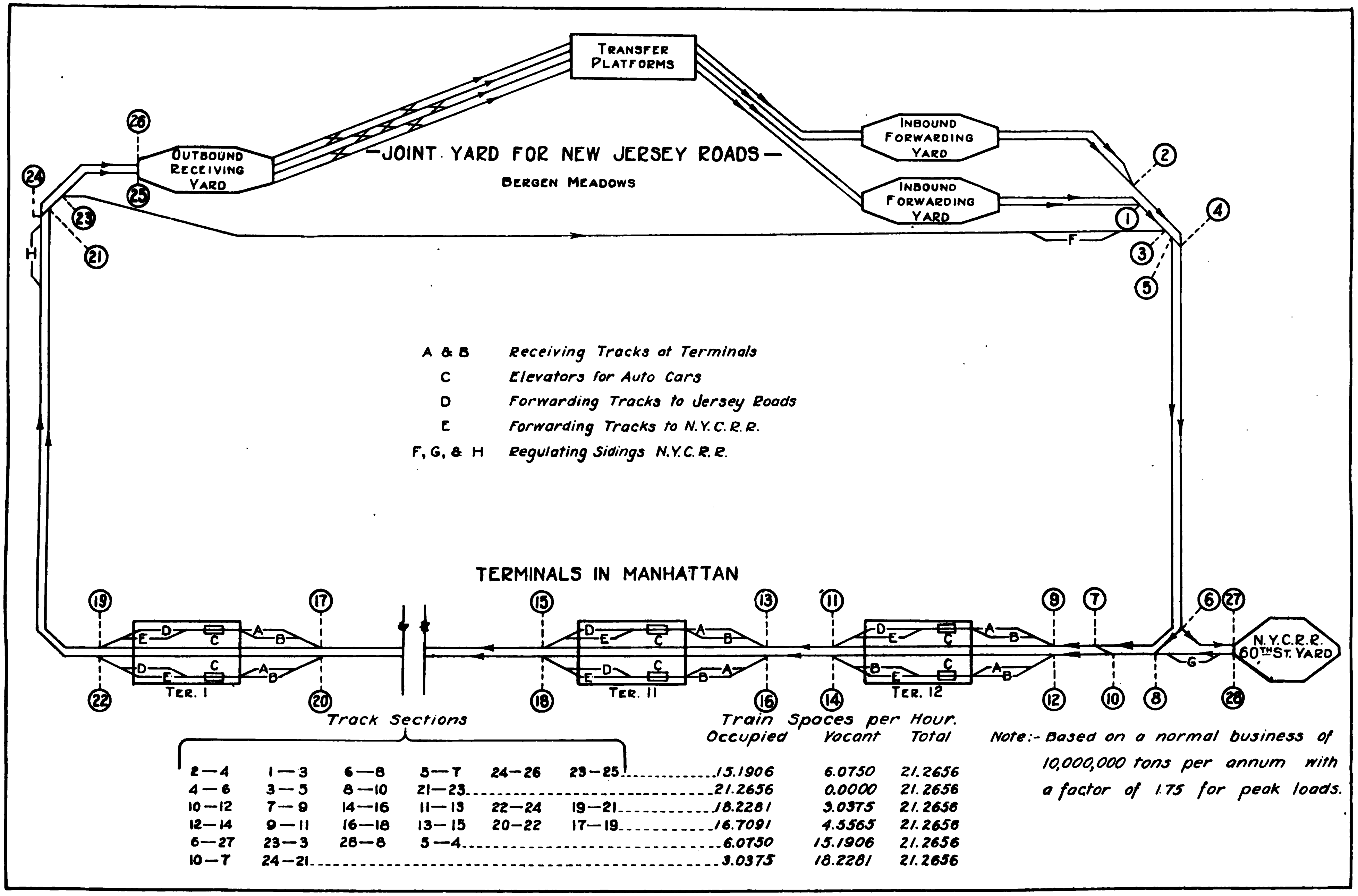
The upper table in Fig. 6 shows 243.05 New Jersey and 48.60 New York Central cars per hour inbound under peak-load conditions with a normal business of 10,000,000 tons per year. Since there are eight cars per train and the New Jersey trains are divided between two tracks, this means 21.2656 trains per hour, of which 15.1906 will be New Jersey trains and 6.0750 New York Central trains. This means average train intervals of 2.821 minutes. As the trains operate at a uniform speed from the points (1) and (2) to (25) and (26) except as they are diverted from the main-track system at (6), (23) or one of the terminals, it follows that the same basic train interval must be maintained throughout.

TRAIN SPACES—OCCUPIED AND VACANT

In other words, the operating schedule shown in the table in Fig. 9 is based on the provision of so many train spaces per hour, whether occupied or vacant. In the governing sections 3–5, 4–6, 8–10 and 21–23, the spaces will be entirely filled. In all other sections there will be vacancies. In 6–8 and 5–7, for example, all of the New York Central trains will be eliminated. In 10–12, 7–9 and the corresponding sections between terminals, on the other hand, half of the New York Central tonnage will be found, and these sections will carry exactly half of the total traffic.

Whenever a train leaves the main track to enter a terminal, as at the point (9), another train departing from the same terminal must take its place, as at the point (11). Otherwise the outbound train will have to wait for the next vacant space, letting two or three trains go past. In general every twelfth train on each main track will run into a given terminal. The provision for extra receiving and forwarding tracks at the terminals makes possible some deviation from this arrangement.

The New York Central and New Jersey trains on the governing sections, such as 3–5, will be in substantially the proportion of two to five, according to present tonnages. If a fleet of three New Jersey trains is followed by a New York Central train and then a fleet of two New Jersey trains is followed by a New York Central train, this ratio will be provided for, and the gaps caused by the turning off of the New York


TRANSFER PLATFORMS
OUTBOUND RECEIVING YARD
INBOUND FORWARDING YARD
INBOUND FORWARDING YARD
—JOINT YARD FOR NEW JERSEY ROADS—
BERGEN MEADOWS
A & B Receiving Tracks at Terminals
C Elevators for Auto Cars
D Forwarding Tracks to Jersey Roads
E Forwarding Tracks to N.Y.C.R.R.
F, G, & H Regulating Sidings N.Y.C.R.R.
TERMINALS IN MANHATTAN
TER. I
TER. II
TER. 12
N.Y.C.R.R. 60TH ST. YARD
A
B
C
D
E
F
G
H
①
②
③
④
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Note:- Based on a normal business of 10,000,000 tons per annum with a factor of 1.75 for peak loads.

Track Sections						Train Spaces per Hour. Occupied	Vacant	Total
2—4	1—3	6—8	5—7	24—26	23—25	15.1906	6.0750	21.2656
4—6	3—5	8—10	21—23			21.2656	0.0000	21.2656
10—12	7—9	14—16	11—13	22—24	19—21	18.2281	3.0375	21.2656
12—14	9—11	16—18	13—15	20—22	17—19	16.7091	4.5565	21.2656
6—27	23—3	28—8	5—4			6.0750	15.1906	21.2656
10—7	24—21					3.0375	18.2281	21.2656

Fig. 9 — Operating Diagram of Automatic-Electric System, Showing Intensity of Use of Various Sections of Track Under Peak Operating Conditions Anticipated in 1929

Central trains at (6) will be spaced with fair uniformity. Beyond the points (7) and (10) every seventh space will be vacant, with 1.519 spaces per hour in addition alongside the terminals.

The basic interval of 2.821 min. between train spaces can be somewhat reduced, to a point where the dead section of track behind one train holds back the succeeding train. This point, it is figured, will be reached when the average interval is reduced to 1.98 minutes. The interval will not be uniform as between New York Central and New Jersey trains, for the reason that New York Central trains entering the system will be acquiring momentum while the New Jersey trains are moving at full speed, and so will fall behind their proper position and be nearer the train behind than the train ahead. The minimum spacing will be 1.495 minutes.

The theoretical annual traffic that can be handled on this basis is 14,246,000 tons, the third basic figure of the upper table of Fig. 9, assuming a peak-load factor of 1.75 with a 16-hour day to handle it.

Improved New York Central Junctions

A further element of expansion remains, and that is the double-tracking of the lines devoted exclusively to New York Central trains, and the elimination ot grade crossings at the junctions with the tracks used by the New Jersey roads. This, with the minimum train spacing before referred to, would make possible a business of 16,620,000 tons per year if it could be operated up to its theoretical capacity. It would probably be unsafe even on this basis to count on handling more than 16,000,000 tons per year. The increased traffic would have to be entirely traffic of the New York Central or of other roads using the New York Central tracks. The changes would not increase the capacity of the system for New Jersey traffic handled in the way proposed.

It is apparent in this connection that additional terminals could be built as needed and connected into the system in series without increasing the load on any one terminal or hampering the capacity of the system as a whole.

Summary of Capacities

To summarize the capacities of the system, it is thought that the limits of the terminal capacity with twelve terminals is a normal business of 10,000,000 tons per year, with a peak factor of 1.75 and a 16-hour operation; and that the practical limit of the electric main line is a normal business of 14,246,000 tons per annum, in spite of the figure of 16,620,000 tons with the improvements suggested. It is believed that 14,260,000 tons is the practical limit of the steam belt line, the steam yard and the electric yard. Five additional Manhattan terminals with the original twelve would have substantially the same total capacity. Such a tonnage would mean an expansion of 58 per cent over the estimated business of 1924, or 42.6 per cent over that of 1929, for which the terminals are designed. At the present rate of increase it would handle the traffic until 1943.

Two Systems in Parallel

The entire electric section of the automatic-electric system is so laid out that it is virtually two separate and parallel systems — each with its main track in a separate tunnel, and its half-terminals complete as to sidings, elevators and platforms. The joint yard has parallel electric units throughout. Breakdown connections with existing electric power plants are contemplated to insure against failure of the electric power. Consequently the system will be well safeguarded against stoppage through accidents. A derailment on one of the main tracks would leave half of the plant in operation. An accident to one elevator would merely reduce the capacity of the plant one twenty-fourth.

An elevator delay of short duration, up to half an hour or considerably more on days of light traffic, can probably be taken care of by utilizing both approach tracks of the half-terminal for incoming trains and speeding up the elevators slightly when all are again in commission. If both approach tracks are occupied and a third train arrives for the half-terminal, it can simply be kept on the main track and returned to the joint yard, or there can be an understanding with consignees that under such conditions the goods may be delivered at the nearest terminal available.

Non-Interference with Present Operations

A very important temporary advantage the automatic-electric system has over a number of other plans considered is the possibility of building the plant and placing it in service without interference with present operations. Other projects would involve tearing up existing tracks or abandoning existing piers to make way for the new construction; but the joint yards, the main line and the inland Manhattan terminals will all be in territory not in present railroad use.

The Commission estimates a construction period for the system of three years under the most favorable conditions. The carrying charges during construction are a large item of the cost of the plant. To construct a plant piecemeal by releasing a few piers and tracks in present use at a time would greatly extend the construction period and increase the interest during construction, while the interference with the operation of facilities already overcrowded and inefficient would result in untold confusion throughout the period.

Electrical Features

The system can be operated by either direct or alternating current, but the latter seems better adapted and has been assumed in the estimates. If alternating current is used it will probably be generated and transmitted at 13,200 volts and stepped down at frequent substations to the voltages ranging from 550 down to 135 required in operation. The cars will receive their power through pantagraphs from two overhead trolley wires. Each car will be equipped either to run singly or to haul something more than its own weight in a train, so that one or two standard railroad cars can be made part of an 8-car train.

In order that the uniform speed necessary for the correct spacing of the various kinds of trains can be maintained, it is proposed to use squirrel-cage induction motors of moderately high torque, two to each automatic car. These motors will be so designed as to give good operating characteristics over a range of frequency of 60 cycles down to 10 cycles, the voltages being reduced in the correct proportions. On the main tracks, where a speed of 1,200 ft. per min. is to be maintained, the power will be supplied at 3-phase 60 cycles, 550 volts, while on sections where the desired speed is 200 or 600 ft. per min., the power will be supplied at correspondingly lower voltages and frequencies.

It will be necessary to distribute the power at high voltage and step it down to track voltage at short intervals in order to prevent excessive voltage drop in the trolley wires and tracks. Each car will have a simple reversing switch for its two motors, so that when on the low-speed sections of track an operator will be able to start, stop or reverse the car at any time. Each of the two motors will be provided with a delayed-action solenoid brake, so that when the power is shut off the car will coast a short distance before the brake takes hold and brings it to rest. This delayed action is necessary to allow the car to coast over dead sections of track which will be necessary at various points.

Movements of the cars singly at the 200-ft. speed will be accomplished by the simple process of having a man standing or walking alongside throw a switch on the car. The car will be under manual control at all times, but will not require a rider, and can be sent considerable distances from one operator to another.

ACCELERATION AND DECELERATION

Acceleration and deceleration of the main-line eight-car train to and from the speed of 1,200 ft. per min. will be effected by means of a special section of track energized by a motor-generator set whose motor is of the variable-speed direct-current type — the motor-generator set being under the complete control of the chief train despatcher, but operating automatically as the switches are turned.

When the cars on the forwarding tracks are made up into eight-car trains, the current will be cut off from the track on which the train is standing and the switches of all eight cars will be closed in the forward direction. The chief despatcher by means of the motor-generator set will energize the track at 10 cycles, 135 volts, which will begin accelerating the train. The speed of the motor-generator set will automatically gradually raise the power supply to 60 cycles, 550 volts, which will bring the train to its full speed of 1,200 ft. per min. All of this will be accomplished at a rate of acceleration of 1 ft. per sec. per sec. or in a distance of 200 feet.

When the train has obtained its full speed it will run off the make-up track and enter the main track, when it will continue at this speed without further attention until it is switched into a decelerating section, while the motor-generator set will be released for use in accelerating the next train.

In the decelerating sections the process will be reversed, a variable-speed motor-generator set reducing the frequency from 60 cycles to 10 cycles and bringing the train to rest in 200 ft. after the deceleration is applied.

Where individual cars must be accelerated from a speed of 200 ft. per min. to one of 600 ft. per min. in the New Jersey yard, the headway is too short for a variable-speed motor-generator set; hence it is proposed to use sectionalized tracks with different frequencies on each section. For example, a yard man will despatch a car on a 10-cycle section by closing the car switch, and the car will automatically accelerate to 200 ft. per min. At the desired point it will enter a section of track energized at 30 cycles, and with the correct operating voltage for this frequency. This will accelerate it to approximately 600 ft. per min. Again, the car will enter another section energized to 10 cycles and 135 volts, and its speed will be automatically reduced to 200 ft. per min. All of this will be accomplished with no man control other than the original starting of the car.

TRAILING DEAD SECTIONS

Ordinarily the eight-car trains, moving at a uniform speed varied only slightly by different conditions of load and grade, will maintain their proper spacing and be safe from collision. Provision must be made, however, for the protection of trains brought to a stop through derailment, burned-out motors or other causes. This provision is made by the use of trailing dead sections.

Throughout their length the main tracks will be divided into insulated sections of a train length plus the distance required to bring the train to a standstill from full speed. The electrical circuits will be so arranged that the current will be completely cut off from the second section behind each train, this dead section advancing as the train advances. If through any accident or error in despatching a train should come within the established distance of the train ahead, it will run upon this dead section and be stopped by the application of the brakes. When the train ahead gets far enough in advance, the dead section of track will automatically become energized and the train which has been stopped will be brought to speed again.

These dead sections, besides protecting trains stopped on the main line by accident, will prevent the despatching of a train from a terminal too close to the train ahead of it or behind it, the system in effect interlocking the forwarding tracks with the main tracks. If for any reason all trains are stopped, all will automatically start in the correct sequence and with safe spaces between them when the power is turned on again.

TRAILING LIGHT SYSTEM

Supplementing the trailing dead sections will be a trailing light system. In front of the chief despatcher's desk will be a large sectional map showing the entire main trackage of the system. As each train is despatched from any point on the system, a light will appear at that point on the map, and will follow the track in such a way as to show at all times the location of that train. If for any reason the train comes to a stop, the light will stop and will indicate to the chief despatcher that there is trouble at that particular point, since no trains are supposed to stop on the main track.

Thus the trailing dead sections will prevent collisions, and the trailing light system will enable the despatcher to send repair men immediately to the point of trouble.

POWER STATIONS

As the Commission's investigation of existing electric power plants in the Port District (Chapter 31) showed that there is no surplus power available for such a large plant, it is assumed that a power plant will have to be provided. A break-down connection should be obtained with existing power companies as a reserve source of power.

The main power station of the system will be located at the New Jersey yard. It will contain standard turbine-driven alternators generating power at 60 cycles and probably at 13,200 volts. Motor-generator sets will then be used for obtaining the necessary direct current and the various frequencies as required.

The power supply for the Manhattan side will be transmitted through lead-covered cables running in the tunnels at 13,200 volts, 60 cycles. The Manhattan substations will contain the necessary transformers and motor-generator sets for accelerating and decelerating the trains and for obtaining the permanent 10-cycle power supply for the low-speed sections of track in the terminals. The elevators in the terminals will presumably also obtain their power from the transformer stations. For the twelve terminals there will be twelve substations.

Special Equipment

Under the head of special equipment for moving the freight by the automatic-electric system, there will be required 1,030 special cars, 380 platform tractors, 30,000 trailers and 48 car elevators. This does not take into account ordinary truck elevators in the terminals for serving upper floors.

It is estimated that 900 special cars, 305 platform tractors and 25,000 trailers will handle peak loads, and consequently there is a liberal allowance for spare equipment.

AUTOMATIC-ELECTRIC CARS

It is proposed to make the automatic-electric cars 58 ft. long between centers of couplers and 8 ft. wide, which will make it possible to run upon them two trains of six 3 x 6-ft. trailers. No working space need be provided for car riders.

As all kinds of general merchandise freight will be carried on the trailers, and as the tracks are on the surface in New Jersey, on fenced-in right-of-way, the cars will have to be roofed. It is proposed to make them of all-steel construction, with rolling sides for the entire length. It is important that there be no obstacles in the way of rapid moving of the trailers on and off the cars, inasmuch as the cars cannot ordinarily stand more than a few minutes in one position.

Presumably there will be more than one type of car. Certain bulky packages — anything that can be handled in an ordinary box car — and also motor-truck bodies to be delivered at the Manhattan terminals to motor-truck chassis for delivery at store door will be loaded upon the cars direct, without the use of the trailers, and for such commodities it will be desirable to have a minimum number of side posts or eliminate the side posts and roof entirely. Other cars will require refrigerator bodies for perishable freight. For estimating purposes the cars are assumed to be all of one type.

TRAILERS AND TRACTORS

For the trailers simple four-wheel low platform trucks with end frames to hold the loads are recommended. Platforms 3 x 6 ft. or slightly smaller will be a convenient size for use on the automatic-electric cars and for running into and out of standard freight cars. The distances these trucks must travel, especially on the 2,000-ft. platforms of the New Jersey transfer station, make it desirable that manual operation of them be minimized. It is proposed, therefore, that they be hauled by storage-battery electric tractors in trains of from four to six trailers.

In loading an automatic-electric car, the tractor will probably be able to haul two four-trailer trains on the middle of the car, while the remaining two trailers at each end will have to be put on by hand.

ELEVATORS

The elevators will be electrically operated platforms 12 x 60 ft., with micro-leveling devices so that they can be brought quickly to a standstill at the exact level required to move the cars on and off, and with interlocking devices to prevent movement of the elevators when the cars are not in proper position. They are designed for an operating speed of 100 ft. per minute.

In each terminal there will be two elevators running down to the tracks and two shuttle elevators. In the entire system there will thus be forty-eight elevators. Elevators of this capacity are in service at various points, and they present no serious obstacles. Momentary delays in their operation can be absorbed by subsequent speeding up and the use of the extra receiving and forwarding tracks at the terminals. More extended repairs can be made at night. A breakdown of three or four elevators at one time, which would be unlikely, would reduce the total output of the terminal plant, but in no such degree as it is reduced frequently under present methods by fog, ice or other adverse conditions.

Automatic Electric System for London Postal Service

While the automatic-electric system proposed for New York has no counterpart as to magnitude in present operation, there is precedent for the principle in the automatic-electric system about to be installed to carry mail underground between the general post office at London and various district offices.

This London project arose from an extended study made by a department commission about ten years ago. That commission reported favorably on an experimental automatic-electric system, and plans and specifications were completed by 1914 for a working system. Because of the war the plans were not put into execution. Some 6¾ miles of tunnel have been built, however, and bids have recently been invited for the electrical installation.

The plan provides a deep tunnel 9 ft. in diameter, extending from the Paddington Railway Station at the West End through a number of district post offices to the central office at the King Edward Building and thence to Whitechapel at the East End. Provision has been made for extensions to the north and south to reach other railway stations and branch post offices.

In the tunnel are two tracks of 2-ft. gage. At each station there are two sidings with an island platform between them. Cars about 13 ft. long, 5 ft. high and 3 ft. wide, each capable of carrying 1,120 lb. of mail, will be run — entirely automatically — in one, two or three-car trains. At the stations elevators or conveyors will carry the mail between the track level and the street level.

A speed on the main line of 35 miles per hour is contemplated, dropping on the approaches to the stations to 15 miles, and at the stations to 6 miles and thence to a standstill. The system is designed for a two-minute headway, although it is believed that a one-minute headway is feasible. An automatic interlocking block-signal system will be used, with trailing dead sections about one-third of a mile long.

While the department's experiments were made with a direct-current system and its specifications are tentatively so prepared, bidders have been asked to suggest with performance records and guarantees any other system.

III — FIRST AND OPERATING COSTS

At the prices prevailing in 1918, the year established as the basic one for the detailed analysis, it is estimated that this initial installation of the automatic-electric system would cost about $200,000,000 complete, ready for operation. The figures have been brought up to date in less detail by the application of current prices, which show that the system would now cost about $240,000,000.

Operating costs have been worked out on a number of comparative bases, to correspond with different tonnages handled by the system, different rates of interest on the investment and different credits depending on the rentals that might be received from upper stories of the terminals.

Viewed in the most favorable light, the terminal costs from break-up yard to tailboard at 1918 prices by the methods the proposed system will supplant are $2.25 per ton. With the most unfavorable combination of conditions, the charge against the same unit under the recommended plan will not exceed this figure at 1918 prices, while it is entirely within reason to hope that if full use is made of the revenue-producing possibilities of the upper floors of the terminals, the figure can be cut nearly in half. In other words, the plan justifies itself economically from the railroad standpoint itself, without consideration of the vast tangible and intangible advantages the shippers and the public will derive, such as reduced street congestion and trucking costs, increased despatch of goods through the terminals, and release of valuable waterfront to more appropriate uses.

Cost of Construction

Table 2 shows in summarized form the estimated cost of building and equipping this initial installation of the automatic-electric system on the basis of 1918 prices for material and labor. There may be a question as to the rate of interest it will be necessary to pay to raise the money for the enterprise. Therefore the figures have been developed for three rates, 5, 6 and 7 per cent, which are applied both to the construction period and as a permanent charge, reduced to a per-ton basis, against the estimated traffic. The totals for the first cost of the plant, ready to be operated, at these three interest rates are respectively $201,290,390, $203,967,202 and $206,644,014. The figures do not include the remodeling of the Sixtieth Street yard of the New York Central, as it is felt that this should be taken care of by the New York Central. The operating costs per ton, however, assume the same overhead charges for the New York Central as for the New Jersey roads.

TABLE 2 — ESTIMATED COST OF AUTOMATIC-ELECTRIC SYSTEM

A — New Jersey Classification Yard		
Right-of-way	$442,500	
Fill	2,161,250	
Transfer platforms	5,760,000	
Other buildings, including steam and electric shops and their equipment	416,100	
Electric viaduct	1,059,800	
Other bridges	890,700	
Tracks	2,639,255	
		$13,369,605
B — Belt Line in New Jersey		
Right-of-way	$419,000	
Excavation and fill	846,790	
Structures	2,016,350	
Tracks	479,900	
		3,762,040
C — Lackawanna and Erie Interchange Yards		
Right-of-way	$102,300	
Fill	42,400	
Tracks	266,700	
		411,400
D — Tunnels to Morris Street, Manhattan		
Right-of-way	$697,200	
Structures	20,215,820	
Tracks	144,605	
		21,057,625
E — Tunnels to Forty-seventh Street, Manhattan		
Right-of-way	$155,000	
Structures	10,080,250	
Tracks	81,025	
		10,316,275
F — Tunnels in Manhattan		
Real-estate easements, public	$492,000	
Real-estate easements, private	460,000	
Structures	58,061,160	
Tracks	605,265	
		59,618,425
G — Twelve Terminals in Manhattan		
Right-of-way	$18,775,800	
Buildings	37,532,960	
		56,308,760
H — Electrical Installation		
Power station	$2,500,000	
Substations	2,897,500	
Transformers	262,500	
Transmission	3,950,000	
Interlocking and signal devices	4,000,000	
		13,610,000
I — Equipment		
Steam locomotives	$1,025,000	
Automatic-electric cars	6,695,000	
Tractors	682,200	
Trailers	1,050,000	
		9,452,200
Total		$187,906,330
Interest during construction on above total exclusive of equipment based on three-year construction period.		
Interest at 5 per cent		$13,384.060
Grand total		$201,290,390
Interest at 6 per cent		$16,060,872
Grand total		$203,967,202
Interest at 7 per cent		$18,737,684
Grand total		$206,644,014

These estimates are based on terminal buildings with two warehouse floors above the three floors required for railroad purposes. It is estimated that with money at 5 per cent all of the twelve terminals could be built with one additional loft floor for $8,670,000 additional, or with two for $17,340,000. Hence the total cost of the plant with the two loft floors would be $218,630,000.

The estimate is put together in the same form as those in Chapters 9 and 10, covering the standard elevated and underground marginal railroads, with nine main subdivisions. The New Jersey joint yard will be much more costly than would be required for a standard marginal railroad, mainly because of the item of $5,760,000 for transfer platforms. The belt line in New Jersey will be less expensive than estimated for the marginal railroad, because less trackage and simpler structures will be required. The Lackawanna and Erie interchange yards will be virtually identical in either plan.

There will be practically no difference in the costs of the downtown Hudson River tunnels, in the standard underground railroad and the automatic-electric system, but in the uptown tunnel the automatic-electric system has an advantage of $4,788,352. In Manhattan, also, despite the greater length of the automatic-electric line, it has an advantage over the standard subway of $5,385,353, partly because of the smaller number of tracks in the automatic-electric plan — two main tracks and a maximum of six tracks at terminals as compared with four and six tracks throughout in the standard subway — and partly because of the cheaper construction at the great depth proposed. Construction at this depth will be cheaper because tunneling methods can be used instead of the expensive cut-and-cover methods of work nearer the surface, where it is necessary to underpin abutting buildings and maintain existing sewers, water mains and other public utilities and conduits.

In the terminals comes the largest saving of all in favor of the automatic-electric plan. Twelve terminals for the standard underground railroad, it was estimated, would cost $103,080,837. The twelve smaller double-decked terminals for the automatic-electric system can, it is believed, be built for $56,308,760. The saving in this item alone is $46,772,077.

The electrical installation for the plan recommended, embodying the automatic features and other departures from standard electrification practice, will cost considerably more than was estimated for the electrification of the standard subway. The same is true of the special electric equipment, which, however, is to replace the standard railroad cars and release them for other service. The total difference in cost of the electrical features is less than $12,000,000.

Using the 5-per cent interest rate for carrying charges during construction, the first cost of the automatic-electric system ready to be operated would be $201,290,390 as compared with $241,131,507 in the case of the standard subway, an advantage of $39,841,117 in first cost resting with the automatic-electric system.

Increasing the interest rate one per cent adds $2,676,812 to the first cost of the automatic-electric plant; therefore, the first cost at the 6-per cent rate would be $203,967,202, and at the 7-per cent rate, $206,644.014.

ESTIMATED COST AT 1920 PRICES

An independent estimate of the cost of construction on the basis of prices prevailing in February, 1920, was made by the staff of General Goethals. His total, using the same type of tunnel assumed in the estimate covered by Table 2 — namely, single-track tubes with cast-iron lining — using also the costs of electrical installation and equipment used by the Commission's engineering office, and figuring interest during construction at 5 per cent, was $255,992,684. Compared with the total in Table 2 of $201,290,390, this increase of about 25 per cent is believed to be in substantial accord with the increase in the general price level from 1918 to February, 1920.

General Goethals estimates that using concrete-block lining for the tunnels instead of cast iron would effect a saving of $17,666,282 at 1920 prices.

Operating Costs

In considering the relative operating costs of different plans we have first the two basic items of direct costs and fixed charges. The first embraces the labor items in the daily functioning of the plant and the material and labor items in maintaining it in proper condition. The second covers taxes, rentals and interest on the investment.

The total of direct costs increases as the tonnage increases. The cost per ton remains fairly uniform, tending to decrease as the tonnage increases if the plant is efficient and has ample capacity. The total of fixed charges remains constant whatever the tonnage, so long as the plant is able to handle that tonnage, consequently the fixed charges per ton decrease as the traffic increases.

With respect to the automatic-electric system, designed for a traffic nearly double that of the present time, it is assumed that increasing the tonnage will reduce the direct costs per ton somewhat, and the fixed charges in substantially inverse ratio to the tonnage increase. Under the present system, however, the existing facilities are overworked. Increasing the traffic would cause more congestion and so probably add to the direct costs per ton, while further increasing it to the amounts expected in 1924 and 1929 would probably necessitate additions to the present plant, with constant increases in the total fixed charges. It is therefore assumed that these additional items would keep pace with the tonnage growth, and the same unit figures, for both direct costs and fixed charges, are used for present methods, whatever the tonnage.

Table 3 shows the estimated direct costs and fixed charges by successive operations to handle 9,000,000 tons per year over the automatic-electric system, the fixed charges being indicated in three columns corresponding to money rates of 5, 6 and 7 per cent. Table 4 shows similar information on the basis of 10,000,000 tons per year. For ease of comparison Table 5, an amplification of Table 19 in Chapter 6, gives the corresponding figures for present facilities.

Starting from these basic figures for the present and proposed plans, with the different tonnages and the different interest rates, we may assume that it may

TABLE 3 — ELEMENTS IN ESTIMATED AVERAGE COST PER TON AT 1918 PRICES TO OPERATE AUTOMATIC-ELECTRIC SYSTEM, ON BASIS OF 9,000,000 TONS PER YEAR

		Interest rate 5 per cent		Interest rate 6 per cent		Interest rate 7 per cent	
	Total direct costs (*a*)	Taxes, rentals, interest on investment (*b*)	Total, direct and indirect (*c* = *a*+*b*)	Taxes, rentals, interest on investment (*d*)	Total, direct and indirect (*e* = *a*+*d*)	Taxes, rentals, interest on investment (*f*)	Total, direct and indirect (*g* = *a*+*f*)
Classification and switching at break-up yards	$0.1067	$0.0105	$0.1172	$0.0119	$0.1186	$0.0133	$0.1200
Line haul, break-up yards to joint terminal yard	.0578	.0419	.0997	.0485	.1063	.0553	.1131
Classification and switching at joint yard, steam section	.0719	.0762	.1481	.0883	.1602	.1007	.1726
Transfer-platform operations at joint yard	.2044	.0587	.2631	.0680	.2724	.0776	.2820
Making up and breaking up of automatic-electric trains at joint yard	.0296	*	.0296	*	.0296	*	.0296
Handling of automatic-electric trains in transit	.0965	.8734	.9699	1.0121	1.1086	1.1543	1.2508
Breaking up and making up of automatic-electric trains at Manhattan terminals	.0202	*	.0202	*	.0202	*	.0202
Operation of Manhattan terminals	.1814	.4708	.6522	.5456	.7270	.6222	.8036
Total, all operations	$0.7685	$1.5315	$2.3000	$1.7744	$2.5429	$2.0234	$2.7919
Average actual total per ton delivered	0.7472	1.5118	2.2590	1.7516	2.4988	1.9975	2.7447
Credit for saving in car detention	....	....	.1341	....	.1341	....	.1341
Average net total per ton delivered	....	....	$2.1249	....	$2.3647	....	$2.6106

* Included in figure for electric trains in transit.

or may not be desirable to amortize the proposed plant in a given time, that it may or may not be possible to deduct a credit for rentals and warehouse space in the upper stories of the terminals, and that it may or may not be possible to deduct still larger credits from the renting of one additional floor or two additional floors of the terminals for manufacturing or office purposes.

The various possibilities of combination are brought together in Table 6. The upper section of the table represents the conditions in the plant as designed, with three warehouse floors for each terminal, the lowest of which is only partly available for warehouse purposes. The lower section shows the decided advantage of building the terminals one or two stories higher to provide manufacturing or office space at the high rentals obtainable.

TABLE 4 — ELEMENTS IN ESTIMATED AVERAGE COST PER TON AT 1918 PRICES TO OPERATE AUTOMATIC-ELECTRIC SYSTEM, ON BASIS OF 10,000,000 TONS PER YEAR

		Interest rate 5 per cent		Interest rate 6 per cent		Interest rate 7 per cent	
	Total direct costs (*a*)	Taxes, rentals, interest on investment (*b*)	Total, direct and indirect (*c* = *a*+*b*)	Taxes, rentals, interest on investment (*d*)	Total, direct and indirect (*e* = *a*+*d*)]	Taxes, rentals, interest on investment (*f*)	Total, direct and indirect (*g* = *a*+*f*)
Classification and switching at break-up yards	$0.1049	$0.0094	$0.1143	$0.0107	$0.1156	$0.0120	$0.1169
Line haul, break-up yards to joint terminal yard	.0569	.0377	.0946	.0437	.1006	.0498	.1067
Classification and switching at joint yard, steam section	.0693	.0686	.1379	.0785	.1478	.0907	.1600
Transfer-platform operations at joint yard	.1952	.0528	.2480	.0612	.2564	.0698	.2650
Making up and breaking up of automatic-electric trains at joint yard	.0267	*	.0267	*	.0267	*	.0267
Handling of automatic-electric trains in transit	.0885	.7861	.8746	.9109	.9994	1.0389	1.1274
Breaking up and making up of automatic-electric trains at Manhattan terminals	.0182	*	.0182	*	.0182	*	.0182
Operations of Manhattan terminals	.1714	.4237	.5951	.4910	.6624	.5600	.7314
Total, all operations	$0.7311	$1.3783	$2.1094	$1.5960	$2.3271	$1.8212	$2.5523
Average actual total per ton delivered	0.7099	1.3606	2.0705	1.5764	2.2863	1.7977	2.5076
Credit for saving in car detention	....	....	.1341	....	.1341	....	.1341
Average net total per ton delivered	....	....	$1.9364	....	$2.1522	....	$2.3735

* Included in figure for electric trains in transit.

With respect to present facilities, no credits from rentals are obtainable, and no provision is made for amortization. Only three unit totals are derived, corresponding to the three rates of interest.

Considering the 9,000,000 tons per year expected in 1924, the earliest year in which the plant could be put into operation, the system justifies itself at the 5-per cent interest rate without recourse to other credit than the warehouse-floor rentals. The same is true at the 6-per cent rate. At the 7-per cent rate one factory or office floor is required to bring the operating cost down to the figures for present facilities of $2.3255. Two such floors would do this with much to spare.

In the case of the 10,000,000 tonnage per annum, for which the plant is designed, and which can be expected by 1929, the plant will justify itself without any manufacturing or office floors, even with money at 7 per cent, while a saving of nearly 67 cents per ton is indicated through the construction of two such floors.

The difference in operating costs per ton, direct and

TABLE 5 — ELEMENTS ENTERING INTO AVERAGE COST PER TON AT 1918 PRICES TO OPERATE PRESENT FACILITIES

		Interest rate 5 per cent		Interest rate 6 per cent		Interest rate 7 per cent	
	Total direct costs (*a*)	Taxes, rentals, interest on investment (*b*)	Total direct and indirect (*c* = *a*+*b*)	Taxes, rentals, interest on investment (*d*)	Total, direct and indirect (*e* = *a*+*d*)	Taxes, rentals, interest on investment (*f*)	Total, direct and indirect (*g* = *a*+*f*)
Classification and switching at break-up yards	$0.1364	$0.0335	$0.1699	$0.0379	$0.1743	$0.0423	$0.1787
Transfer-platform operations at break-up yards	.6667	.0078	.6745	.0089	.6756	.0099	.6766
Line haul service	.1024	.0490	.1514	.0548	.1572	.0606	.1630
Switching and bridging at waterfront	.2528	.1537	.4065	.1696	.4224	.1855	.4383
Car-float operations	.3280	.0500	.3780	.0567	.3847	.0634	.3914
Freight handling at Manhattan terminals	.9416	.3690	1.3106	.3775	1.3191	.3860	1.3276
Total, all operations	$2.4279	$0.6630	$3.0909	$0.7054	$3.1333	$0.7477	$3.1756
Average actual total per ton delivered	1.6361	0.6164	2.2525	0.6529	2.2890	0.6894	2.3255

TABLE 6—COMPARATIVE OPERATING COSTS PER TON OF PRESENT FACILITIES AND OF AUTOMATIC-ELECTRIC SYSTEM, WITH DIFFERENT TONNAGES AND INTEREST RATES WITH AND WITHOUT AMORTIZATION, AND WITH AND WITHOUT RENTAL CREDITS FOR UPPER FLOORS OF TERMINALS — BASED ON 1918 PRICES

	Interest rate 5 per cent			Interest rate 6 per cent			Interest rate 7 per cent		
		Automatic-electric system			Automatic-electric system			Automatic-electric system	
Item	Present facilities	9,000,000 tons per year	10,000,000 tons per year	Present facilities	9,000,000 tons per year	10,000,000 tons per year	Present facilities	9,000,000 tons per year	10,000,000 tons per year
Direct costs (*a*)	$1.6361	$0.6131	$0.5758	$1.6361	$0.6131	$0.5758	$1.6361	$0.6131	$0.5758
Fixed charges (*b*)	.6164	1.5118	1.3606	.6529	1.7516	1.5764	.6894	1.9975	1.7977
Total (*c*=*a*+*b*)	$2.2525	$2.1249	$1.9364	$2.2890	$2.3647	$2.1522	$2.3255	$2.6106	$2.3735
Credit from rentals of warehouse floors (*d*)	....	.2689	.2420	....	.2689	.2420	....	.2689	.2420
Total less warehouse-rental credit (*e* = *c* — *d*)	$2.2525	$1.8560	$1.6944	$2.2890	$2.0958	$1.9102	$2.3255	$2.3417	$2.1315
Amortization (*f*)	....	.1403	.1263	....	.1415	.1274	....	.1435	.1291
Total including amortization (*g* = *e* + *f*)	$2.2525	$1.9963	$1.8207	$2.2890	$2.2373	$2.0376	$2.3255	$2.4852	$2.2606
*Credit per additional floor per terminal for manufacturing or office purposes (*h*)	....	.3564	.3208	....	.3456	.3110	....	.3345	.3011
Net cost per ton, one such additional floor									
Excluding amortization (*j* = *e* — *h*)	2.2525	1.4996	1.3736	2.2890	1.7502	1.5992	2.3255	2.0072	1.8304
Including amortization (*k* = *g* — *h*)	2.2525	1.6399	1.4999	2.2890	1.8917	1.7266	2.3255	2.1507	1.9595
Net cost per ton, two such additional floors									
Excluding amortization (*l* = *e* — 2*h*)	2.2525	1.1432	1.0528	2.2890	1.4046	1.2882	2.3255	1.6727	1.5293
Including amortization (*m* = *g* — 2*h*)	2.2525	1.2835	1.1791	2.2890	1.5461	1.4156	2.3255	1.8162	1.6584

* Net cost, taking into account additional cost of construction.

indirect, between the existing facilities and those recommended can best be understood in terms of total annual savings and net return on investment. This information, as applied to the expected traffic in 1929 of 10,000,000 tons, and also as applied to the estimated ultimate capacity of the system of 14,260,000 tons (see page 294), is presented in Table 7. In the table the net profit is the excess over the interest on the investment, and the investment in each case is assumed to be only that required to build the facilities utilized—varying from twelve terminals with three floors each opposite the first item to seventeen terminals with seven floors each opposite the last.

OPERATING COSTS AT 1920 PRICES

These operating costs, like the construction costs, have been brought in less detail to a 1920 basis by the application of factors representing the increases in prices of material and labor and by the use of fixed charges based on General Goethals' estimates.

At prices prevailing in January, 1920, with money at 5 per cent, the cost per ton of present operations was estimated to be $2.8237, as compared with $2.2525 at 1918 prices. Handling 10,000,000 tons per year, the corresponding charge per ton against the automatic-electric system, with two warehouse floors in service at each terminal, is estimated at $2.1753, as compared with $1.8207 at 1918 prices. The advantage of the automatic-electric system, amounting to 43 cents per ton at 1918 prices, would thus be nearly 65 cents at 1920 prices.

Generally speaking, a rising labor market will show an increasing advantage of the automatic-electric system over present methods because labor is such a large factor in operations by present methods; while a falling market will probably not wipe out that increase, because the wage scales of skilled operators are not likely to fall as rapidly as construction costs.

SAVING IN CAR DETENTION

Included in all of these estimates of operating costs of the automatic-electric system are credits for the saving in car detention. Under the present system of operation it requires approximately three and one-half days for a freight car to complete the cycle from the break-up yards of the carriers to Manhattan and return. At 10,000,000 tons of freight annually this means about 2,700,000 car days. Under the automatic-elec-

TABLE 7 — ANNUAL SAVINGS AND NET PROFIT OVER INTEREST ON INVESTMENT DERIVABLE FROM AUTOMATIC-ELECTRIC SYSTEM

	Interest rate 5 per cent				Interest rate 6 per cent				Interest rate 7 per cent			
	Saving per ton	Total annual saving	Investment	Net profit, per cent	Saving per ton	Total annual saving	Investment	Net profit, per cent	Saving per ton	Total annual saving	Investment	Net profit, per cent
On Basis of 10,000,000 *Tons Yearly Traffic*												
(1) Plant with only the three necessary floors at terminals	$0.1898	$1,898,000	$192,620,000	0.99	$0.0094	$94,000	$195,180,000	....	$0.1771*	$1,771,000*	$197,740,000*	—0.90
(2) Plant with two additional warehouse floors at each terminal	.4318	4,318,000	201,290,000	2.15	.2514	2,514,000	203,970,000	1.24	.0349	649,000	206,650,000	0.3
(3) Plant with two additional warehouse floors and a loft floor at each terminal	.7526	7,526,000	203,960,000	3.57	.5624	5,624,000	212,760,000	2.64	.3660	3,660,000	215,560,000	1.70
(4) Plant with two additional warehouse floors and two loft floors at each terminal	1 0734	10,734,000	218,630,000	4.90	.8734	8,734,000	221,550,000	3.94	.6371	6,671,000	224,470,000	2.98
On Basis of 14,260,000 *Tons Yearly Traffic*												
(1) Plant with only the three necessary floors at terminals	$0.3633	$5,181,000	$239,450,000	2.16	$0.2085	$2 973 000	$242,720,000	1.23	$0.0557	$794,000	$245,880,000	0.31
(2) Plant with two additional warehouse floors at each terminal	.6053	8,632,000	251,730,000	3.43	45.05	6,501 000	255,170,000	2.55	.2977	4,245,000	258,500,000	1.61
(3) Plant with two additional warehouse floors and a loft floor at each terminal	.9261	13,206,000	264,010,000	5.00	.7615	10,859,000	267,620,000	4.06	.5988	8,539,000	271,120,000	3.15
(4) Plant with two additional warehouse floors and two loft floors at each terminal	1.2469	17,781,000	276,290,000	6.43	1.0725	15,294,000	280,070,000	5.45	.8939	12,834,000	283,740,000	4.51

* Loss.

tric system, in which the standard cars ordinarily are brought inbound only as far as the joint yard, they will complete their cycle, it is estimated, in an average of about thirty-six hours. This means 900,000 car days to handle 10,000,000 tons, or a saving of about 1,800,000 car days.

The value of a car day depends greatly on the volume of traffic moving. The rules of the American Railway Association have established 75 cents per day as the standard charge against one road for the holding of a car of another road. At this price the 1,800,000 car days amount to $1,350,000 per year, or $.1350 per ton. In times of heavy traffic, when there is a shortage of cars, the actual value of these cars released, though not computable, will be much greater.

Part of this saving in car detention through the automatic-electric system is due to the reduced distance traveled by the standard car. Part of it is due to the elimination of delays and slow movements. The average time in transit for a shipment, between the break-up yard and a Manhattan pier station, is 42 hours. The automatic-electric system will cut it to about 16 hours. This saving of 26 hours will go into the pocket of the shipper or consignee.

REDUCTION IN EMPTY CAR MOVEMENT

In Chapter 6, page 165, is set forth the high percentage of empty car movement, for one cause or another, both to and from the Manhattan terminals. The difference to be effected in this respect can be visualized if we trace out the movement of a certain car under the present system and the proposed.

Suppose the Erie brings in a loaded Lackawanna car, destined for Pier 39, Hudson River. It passes through the break-up yard at Croxton, and then is drawn in a short train to Jersey City, put on a car float, towed to Pier 39 and unloaded. Then, although goods are at hand at Pier 39 to fill it, it belongs to the Lackawanna and must be returned to it. Hence it is floated empty back to Jersey City, hauled back to Croxton, classified again there, delivered to the Lackawanna, classified a third time in the Lackawanna's Secaucus yard, hauled to Hoboken, and then perhaps floated to the Lackawanna's Pier 41, two doors from Pier 39, to receive a load. Then it is returned to Secaucus yard and classified a fourth time according to its outbound destination.

Under the proposed system this car, after originally passing through Croxton yard, will be hauled via the belt line to the joint yard. Presumably its contents will be consigned to the union terminal in Manhattan nearest Pier 39, but whichever of the twelve is to receive them, the car will in days of normal traffic be switched to one of the Lackawanna platform tracks. Discharging its load upon trailers at the inbound section of the platform, it will pass along to the outbound section and receive its new load, whence it will be removed to the forwarding yard and thence to Secaucus yard, ready to be classified and despatched in an outbound train.

The enormous saving possible in extra movements within the terminal district is taken into account in the estimates of yard and line-haul costs.

BETTER LOADING OF CARS

Under the present methods the Erie may load a car at Duane Street, another at Pier 39 and still another at Pier 7, East River, all for the same point. There may be no more freight at the three points in a day than would go into one car, but to meet the competition with other roads the Erie must provide the three cars, and despatch each when a certain very small minimum load has been obtained. Under the proposed system all Erie freight for the destination in question will be brought together at the transfer station in New Jersey. The probable result will be the making up and despatching of one car better loaded than any of the three under the present system.

The same saving may be applied to inbound freight. One shipper from the point in question may consign his goods to Duane Street, another to each of the other stations. The same train may bring in partly loaded cars for each station. Under the proposed plan, since bulk is to be broken in any event at the New Jersey transfer station, the freight can all be loaded into one car, and the other cars need not come to the Port District at all.

IV — OTHER BENEFITS OF AUTOMATIC-ELECTRIC SYSTEM

While the automatic-electric system is amply justified by the saving in railroad terminal operations, in the benefits of which the public is bound to share, there are numerous other benefits which will go largely or wholly to the public. These include reduction of truck delays at terminals, reduction in trucking distances, increased average loading of trucks, adaptability of system to recommended improved food-distribution system, reduction of trucking of milk, produce and live poultry from New Jersey, reduction of spoiling of perishable foodstuffs, decreased maintenance of city streets, release of waterfront for shipping purposes, increased real-estate values, increased commercial capacity of Manhattan.

TRUCKING BENEFITS

Trucking losses under existing conditions are discussed at some length in Chapter 17, beginning on page 294. While a number of them have little relation to the railroad terminal situation, others will be greatly reduced if the automatic-electric system is put into operation, and the combined effect will be incalculable.

Reduced Truck Delays — Tables 4, 5, 6 and 7 of Chapter 17 show and classify the delays to trucks at railroad piers as disclosed by the Commission's clockings. On the basis of a yearly traffic of 10,000,000 tons the estimated annual saving through the elimination of unnecessary delays at the automatic-electric terminals is $1,648,000.

Reduced Trucking Distances — Under existing conditions the shipper or consignee must haul his goods to or from a terminal of the particular railroad with which he is doing business, and frequently because of congestion he cannot use the nearest terminal of that railroad. Consequently there is much north-and-south haul that can be eliminated when each automatic-electric station is a union station and the stations are centrally located in zones of substantially equal traffic. On the 10,000,000-ton basis the estimated annual saving on this score is $1,154,000.

Increased Average Truck Loads—The average truck load, the Commission's clockings show, is far below the capacity of the truck. This is due partly to one-way empty movement and partly to the necessity of delivering small consignments to or receiving them from several railroads. Consolidation of the terminals will make it possible to deliver these small consignments at one point, and so will tend to eliminate the hauling of part loads between terminals. Trucks delivering goods at a joint terminal will also be more likely to obtain return loads. While the effect on the average truck load can hardly be computed, it should be considerable.

Reduced Trucking of Foodstuffs—Milk, produce and live poultry are all unloaded in large quantities from cars at the New Jersey waterfront yards and trucked via the ferries to Manhattan. The automatic-electric system, as pointed out elsewhere, will render all of this trucking unnecessary by making possible direct delivery from the proposed joint yard to any point in Manhattan reached by the system.

Likewise the local trucking of foodstuffs within Manhattan and from the primary market in Manhattan to other parts of the Port will be greatly reduced if the improved food-distribution system proposed by the Commission (see Chapter 20) is adopted.

Combined Effect of Trucking Benefits—All of these trucking benefits will work together and tend to augment each other. For example, the elimination of costly delays at terminals will encourage the use of larger trucks and consequently larger loads. Reduction in time and distance and increase of loads will work to reduce the number of trucks required, and those remaining will be able to move more continuously. The cumulative effect in reducing street congestion, if calculable, would unquestionably warrant a large expenditure by the public.

DECREASED MAINTENANCE OF STREETS

Tied up with this great reduction in trucking is the matter of street maintenance. If a considerable percentage of the trucking now done is unnecessary, it follows that the lives of our pavements, to maintain which requires a large public expenditure annually, can be considerably prolonged when the unnecessary trucking is eliminated. This benefit of the automatic-electric system should soon show in reduced taxes.

IMPROVEMENTS IN FOOD DISTRIBUTION

Elimination through the automatic-electric system of unnecessary trucking of foodstuffs is only incidental to the more direct public benefit of fresher food. Every rehandling perishable foodstuffs undergo, every unnecessary mile they are trucked, contribute to the loss of freshness. Deterioration begins when fruits are bruised in handling, or when refrigerated goods are exposed to warm temperatures during transfer, and it increases in the hours or days that lapse before the goods reach the consumer. The food-distribution plan proposed by the Commission, which can function only if the automatic-electric system is installed, will lessen the rehandling, the exposure to damaging temperatures and the lapse of time from freight car to kitchen.

The public should also be able to buy this fresher food at lower prices. The deterioration referred to often becomes actual decay, and the dealers must make up for the loss of unsalable goods. The unnecessary trucking and other waste of the present methods also entail expenses that must be met in the prices of the goods. The benefit of the automatic-electric system from the standpoint of the public's food supply is another large though incalculable one.

RELEASE OF HUDSON RIVER WATERFRONT

Chapter 21 sets forth the advantage to be derived from the release of Manhattan's Hudson River waterfront. This waterfront is in great demand by steamship companies, particularly those operating transatlantic passenger lines, and such use of it is undoubtedly more appropriate than use by railroad companies that can be accommodated inland. Furthermore, the entire pier layout, which consists mainly of narrow single-story piers with little in the way of supporting warehouses, requires reorganization to conform to the needs of present-day shipping; but only through the release of a considerable number of the existing piers, such as the construction of the automatic-electric system will accomplish, can an effective start be made at the waterfront without working hardship on its present occupants.

The New Jersey waterfront opposite Lower Manhattan is no less in need of reorganization, inasmuch as it is occupied largely with railroad yards to the exclusion of steamships. The possibilities of this waterfront are discussed in Chapter 22. The automatic-electric system will not of itself remove enough tonnage from the waterfront to make extensive changes possible, but through it, the removal of interchange and the consolidation of lighterage and car-float operations, it is estimated that 50 per cent of the waterfront in railroad use will be released and can be developed for steamship terminals with direct service.

INCREASED REAL-ESTATE VALUES AND CAPACITY FOR BUSINESS

The automatic-electric system and its accompanying benefits will tend to make all of the central part of the Port a more desirable place in which to do business. Companies that have contemplated moving their establishments to other ports will see the advantage of remaining at New York, and new enterprises will be attracted. Real-estate owners who have been discouraged from erecting modern business buildings on their property because of the uncertainty of attracting tenants will find this all changed, and the demand for space a strong incentive to modern development. The commercial and industrial capacity of the territory reached by the system will be greatly increased, and the entire Port District will receive a new impetus.

STORE-DOOR DELIVERY

The Commission in its epitomized recommendations urges the inauguration of partial or voluntary store-door delivery as a measure for immediate relief. The automatic-electric system is admirably adapted to a continuation of this voluntary procedure. In the case of small shipments, the trailer trucks can be run upon the drays and delivered at the store door without further handling. Shipments too large for the individual trailer trucks can be transferred from the cars to special truck bodies at the joint yards, hauled on roofless automatic-electric cars to any of the Manhattan terminals and there transferred to motor-truck chassis for delivery at the store door.

Summary of Items of Saving

A summary of the items of saving of the automatic-electric system is presented in Table 4 of Part I, the summary of the Commission's joint report. It is here reproduced as Table 8.

Table 8 — Saving by Automatic-Electric System on Basis of 10,000,000 Tons Handled Annually

1.	Saving over present system in railroad operation	$4,318,000
2.	Saving in truck delays	1,648,000
3.	Saving in trucking distances	1,154,000
	Total	$7,120,000
	Per cent above 5% interest on $201,190,000	3.54%
4.	Net rentals from two additional loft floors	6,416,000
	Total saving	13,838,000
	Per cent above 5% interest on $218,630,000	6.22%

Important Items of Saving Impracticable to Estimate Accurately

5. Increased average loading of railroad cars.
6. Increased average loading of trucks.
7. Saving to public through quicker terminal movement.
8. Reduction in trucking expense to tenants of terminal buildings.
9. Reduction of trucking of milk, produce and live poultry from New Jersey.
10. Inherit possibilities of saving in spoiling of food.
11. Decreased maintenance in city streets.
12. Freedom from interruption by fog and ice.
13. Increased real estate values.
14. Increased commercial capacity of all Manhattan.

V — WIDER USES OF SYSTEM

The automatic-electric system, demonstrated to be economically justifiable and highly desirable merely as a substitute for the pier-station operations of the New York Central and the New Jersey railroads in lower Manhattan, has much wider possibilities. With the provision of the necessary rail connection in upper Manhattan and of additional terminals in the system itself, it can be made to accommodate the pier-station freight of the New York, New Haven & Hartford and the Long Island railroads; and by the expansion of the general idea through additional tunnels, yards and terminals, all of the railroads of the Port can be made to serve all of Manhattan, Brooklyn, Newark and other sections which now depend primarily on the service of one, two or three railroads.

New Haven and Long Island Tonnage

A plan which on the one hand closed the East River pier stations of the New Jersey roads and left those of the New Haven and Long Island, and on the other hand excluded the New Haven and Long Island from union terminals in the heart of Manhattan, might meet with serious objection from the railroads interested. This objection can be removed by the inclusion of all roads.

In 1914 the Manhattan pier-station tonnage of the New Haven and Long Island was 887,056 tons. The same figure was used for 1929, as there has been little increase in the last fifteen years. A larger percentage of their tonnage is outbound than in the case with the New Jersey railroads, so that a larger part of the additional load would fall where it could best be handled. The total would come well within the estimated capacity of the system of 14,260,000 tons per annum, although the excess capacity would not be sufficient to provide much farther into the future.

Expansion of System

Time has not been available for elaboration of the system in as great detail as was applied to the initial development, but the outline summary of the comprehensive plan, shows its general characteristics.

Utilizing the same joint yard in New Jersey and the same Hudson River tunnels, a new Manhattan loop branches from the original loop, and passing through both the west and east sides of upper Manhattan, connects with a second joint yard tentatively located on Wards and Randalls islands. The expanded system opens up virtually all of Manhattan to all of the railroads of both the New Jersey and the New York groups on equal terms. The various possible routes can readily be traced out on the map. The three New York roads will use the return route through New Jersey, as will the New York Central in the initial development, while the New Jersey roads to reach upper Manhattan will use both loops.

The plan shows a station in the Bronx. Such a station would be especially desirable as a point of delivery of foodstuffs to a secondary market center in its vicinity.

The Commission does not advocate building the joint yard for the New York railroads on Wards and Randalls islands, which could be more appropriately turned into public parks. The yard should preferably be built near the East River in either Queens or the Bronx, where a suitable site could doubtless be found. Either location would be accessible to all three New York railroads through the New York Connecting Railroad.

The expanded system has three principal advantages over the initial development:

1. It brings the New York, New Haven & Hartford and the Long Island railroads into the automatic-electric plan on equal terms with the other railroads.

2. It gives direct service from all of the railroads to sections of Manhattan without any such service or dependent wholly on one road.

3. It provides a complete solution of the Riverside Park problem.

The third advantage is of great importance. The Commission has not heretofore discussed the complexities of the New York Central problem above Sixtieth Street — whether it is possible at once to provide the needed trackage, which the railroad company now lacks, to handle the traffic efficiently, and place this trackage where it will not be aesthetically objectionable. It is not necessary to discuss them now, for the expanded system eliminates the problem entirely. The initial development removes the tracks south of Sixtieth Street, retaining only the Thirty-third Street yard as a float-bridge yard. The expanded system will eliminate those from Sixtieth Street to Spuyten Duyvil. Additional tracks, as a part of the joint belt-line system, will need to be laid along the Harlem River line from Spuyten Duyvil to Mott Haven Junction and a connection constructed with the New York Connecting Railroad. General merchandise freight and express handled by the automatic-electric system will take this route. Much of the New York Central's lighterage traffic can be diverted to the West Shore, while auxiliary lighterage and car-float terminals to serve the New York Central territory east and south of Albany can be established on the East River in the vicinity of Port Morris.

Here again the great advantage of non-interference with present operations is apparent. Solutions of the Riverside Park problem that leave the New York Central on the west waterfront make necessary the expensive piecemeal reconstruction under traffic, and the unsightliness of the park for many years.

VI — CONCLUSION

The Commission urges the installation of the automatic-electric system as the solution of the West Side and Manhattan freight-distribution problem. Such a system will be vastly cheaper to operate than the present pier-station system and can be installed at a sufficiently low cost to enable the tonnage available to carry the interest burden from the start of operation, while it will have a margin of expansion sufficient to handle the traffic for a considerable period into the future, the total operating cost per ton decreasing as the traffic increases.

Besides the direct benefits derived from the reduced operating costs, the indirect benefits through reduced trucking costs and delays, released waterfront, increased real-estate values and the like will be incalculable.

Through the construction of additional tunnels, terminals and yards, the automatic-electric system is capable of expansion throughout the Port if future conditions warrant. The solution of the entire Port problem depends upon a correct solution of the Manhattan problem, and the Commission urges the adoption of the automatic-electric plan as that correct solution.

CHAPTER 15

Railroad Service for Long Island

That part of Long Island within the Port District — that is, the boroughs of Brooklyn and Queens, City of New York — has all-rail service from the Long Island Railroad direct, and via the New York Connecting Railroad from the New York, New Haven & Hartford Railroad. The other trunk railroads of the Port also give service to the two boroughs, but all depend on some form of marine service. The Pennsylvania Railroad, which controls the Long Island and is a half-owner of the New York Connecting Railroad, utilizes those roads in conjunction with a car-float service across the Upper Bay, between its Greenville yard and Bay Ridge, Brooklyn. The other New Jersey railroads and the New York Central reach only the vicinity of the waterfront — some through a small number of pier stations and float-bridge terminals of their own (see Chapter 6, "Present Railroad Facilities, Methods, Tonnages and Costs," page 137), and all through private float-bridge terminals.

Bay Front of a Part of New York Dock Company's Terminal — Brooklyn's Most Extensive Private Terminal

These private float-bridge terminals are all union terminals for the freight of all railroads of the Port District. They consist of the Bush Terminal, the facilities of the New York Dock Company, the Jay Street Terminal and the three Long Island terminals of the Brooklyn Eastern District Terminal Company. All of them are described briefly in Chapter 6, pages 137 and 138, and the facilities of the Bush Terminal and the New York Dock Company, which include piers and warehouses utilized by ships in all trades, are described at greater length in Chapter 18, "Warehousing."

The freight service Brooklyn and Queens receive under the present system is not well co-ordinated, consisting as it does of a series of unrelated units, and except where direct rail connections are available it is unduly expensive to the carriers, to the private terminals, and so indirectly to the industries and inhabitants of the two boroughs.

The Commission's plan contemplates the use of part of the Long Island Railroad and all of the New York Connecting Railroad as a middle belt line. This line will be connected by rail at the northerly end with the New Haven and New York Central railroads, while at the southerly end connection will be afforded with the New Jersey roads temporarily by car ferry and ultimately by a tunnel or tunnels providing direct rail access. At intervals along the route there will also be connections with the Long Island Railroad.

The middle belt line will provide service from all railroads of the Port District, not only for Brooklyn and Queens, but for all of Long Island via the rails of the Long Island Railroad, and from it will lead various inner or waterfront belts along the waterfront of Brooklyn and Queens.

Queens

To the Borough of Queens the Commission's plan brings the possibility of development of the northerly or East River and Flushing Bay waterfront by a marginal railroad leading from the middle belt near its northerly end and connecting with the Long Island Railroad at or near Flushing Creek. For the marsh land districts of this section, canalization after Type VI of Chapter 23 under the head of "Suggested Plans" has its possibilities. Types II, III, IV, V and IX are suggested for this shore, although it is probable that most of the section will develop industrially before its commercial development comes, and that quay development with sheds like those of Type IV will be most suitable at first.

To the westerly or East River shore the same possibilities can be developed by means of an inner or waterfront belt line extending from a connection at its northerly end with the middle belt line, along the shore to a connection with the Long Island Railroad near the mouth of Newtown Creek.

A quay development along the westerly shore with sheds after Type IV of "Suggested Plans" is probably the most suitable, although piers created by dredging out slips inshore of the pierhead line are possible.

The improvement of the East River as outlined in Chapter 24, "Channel Improvement," is nearly as vital to the Borough of Queens as is the belt line system.

In 1914 the rail tonnage in the district to be served by this inner belt totalled 3,172,000 tons, but all but 225,000 tons of this was interchange between the Long Island Railroad and all other railroads of the Port, and

1,715,000 tons of it was coal, coke and similar commodities. This tonnage together with the tonnage which would be induced by such a water belt line indicates the possibility of building the line at some time in the near future. It is to be served when built both by rail direct and by a float-bridge station about midway of its length, connecting it immediately with all the railheads of the Port.

The southerly or Jamaica Bay shore of Queens is to be served by an inner or waterfront belt line connecting with the middle belt line and by means of it with all the railroads of the Port District.

The city's plan as outlined on a map compiled and prepared in conformity with instructions from the Board of Estimate and Apportionment under date of January 1, 1915, contemplates a main channel 1,000 ft. wide along the pierhead line, paralleling the shores of the Bay, with basins of some length extending inshore.

The Commission suggests canalization after Type VI of "Suggested Plans" with a quay development and sheds after Type IV, and later, when the economic possibility appears, piers and warehouses after Types V and IX.

Brooklyn

Belt-line projects for the west waterfront of Brooklyn have been under consideration for a number of years, and the Commission has given careful consideration to the reports available on them.

Belt Line for West Waterfront

In 1914 the construction of a marginal railroad from Sixty-fifth Street, Bay Ridge, along the shores of the Upper Bay and the East River to Fulton Street near Brooklyn Bridge was proposed, and a few months later the Board of Estimate and Apportionment of the City of New York adopted a plan known as the "South Brooklyn Terminal Railroad" and a sum of $9,000,000 was appropriated for its construction. Most of this money was expended for right-of-way but no construction followed. This marginal railroad approximately 5½ miles long was to have had both float bridge and rail connections.

The district to be served by the northerly half of this marginal road had a rail business of 1,049,000 tons in 1914, which it is estimated will have reached 1,458,000 by 1929. That served by the southerly half had in 1914 936,000 tons, which will be increased to approximately 1,301,000 tons by 1929.

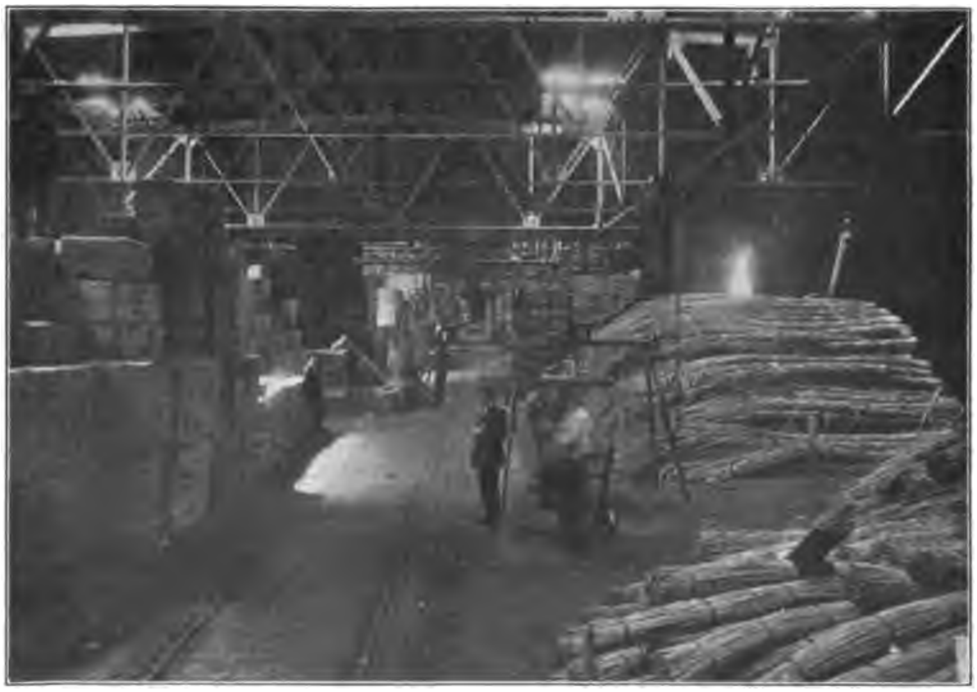
The Commission believes that its inner or waterfront belt line for this district will be justified by the tonnage, but thinks that the line should be built in two sections — the most northerly to be served by float bridges connecting with all the railheads of the Port, the most southerly by direct connection with the middle belt line and a float bridge station connecting it immediately with all the railheads of the Port, and the two sections to be joined ultimately by an over or under crossing of Gowanus Canal.

In April, 1918, a committee composed of citizens of the Borough of Brooklyn and representatives of the United States Railroad Administration was formed to study and report on means of relieving the freight congestion in Brooklyn.

In July, 1918, this committee made a report recommending the construction of a double-track electrically operated railroad located in the streets and on the uplands and extending from the United States Navy Yard at Flushing Avenue northerly along the East River to a point near Newtown Creek, thence southeasterly along the shores of Newtown Creek to a connection with the Long Island Railroad at Montrose Avenue near Bushwick Yard, a total length of approximately 5½ miles. The railroad was to be served direct by rail from the Long Island Railroad and its connections, and by float bridge from the New Jersey roads.

A total of 1,614,000 tons represents the rail tonnage of the district which would have been served by this inner belt in 1914 had it then been in existence, and by 1929 it is estimated that the rail tonnage will have reached 2,244,000 tons. The Commission believes that such a belt served by all of the railroads of the Port would be of great advantage to the section and that by 1929 or even before that time sufficient tonnage will be found to justify its construction.

The total rail business of the westerly shores of Brooklyn and Queens between Bay Ridge and Hell Gate in 1914 was 6,771,000 tons. Of this the New Jersey railroads contributed all but about 500,000 tons,



Interior of a Bush Terminal Pier — Note Disuse of Track and High Tiering Due to Insufficient Pier Width

Brooklyn Eastern District Terminal—A section Devoted to Delivery on Team Tracks of Car-load-Lot Business

which were handled by the New York Central and the New Haven railroads.

Assuming for the Brooklyn and Queens traffic the rate of expansion ascertained for Manhattan, which is a conservative assumption, the total rail business that may be expected within these limits by 1929, excluding lighterage, will approximate 10,000,000 tons. The character of this traffic has been analyzed and it appears that a little less than one-third was coal and coke, all of which, except a comparatively small amount floated to the South Brooklyn yard of the Lackawanna Railroad at Twenty-fifth Street, was interchanged with the Long Island Railroad at Long Island City. If to this coal and coke tonnage is added the tonnage of building materials, and that of grain and grain products, bulk commodities measure about 45 per cent of the total. The principal part of the remaining 55 per cent was sugar, coffee, hides and other commodities that take carlot delivery.

At present the private terminals within this district are conducting their business by lighters, car floats and short marginal railroads, possibly at a loss as far as their marine operations are concerned and with no profit on the marginal railroad operation.

The consolidation of car-float and lighterage service proposed by the Commission will render such service less expensive to this section, and while the waterfront belts proposed along the westerly shores of Brooklyn and Queens will occupy to a large extent the marginal roads of these various private terminals, the terminals will undoubtedly be glad to turn over all marine operations and the operations of their marginal railroads to such a consolidation of service as the Commission proposes.

Pier Types

Most of the westerly Brooklyn shore is already extensively developed, but the piers are old and in many instances inadequate. Remodelling is suggested, not only to make the piers large enough to afford sufficient transit space, but to adapt them to the direct rail service from all railroads of the Port which is so essential to adequate shipping centers. In this remodelling, as well as in new construction, Types II, III, V and IX will be suitable at various locations.

Along the banks of Newtown Creek quay development seems to be the most suitable, with sheds after Type IV of "Suggested Plans."

Jamaica Bay

The southeasterly or Jamaica Bay frontage of Brooklyn the Commission purposes to serve by an inner or waterfront belt line leading from the middle belt line.

The city's general plan for the development of this section as indicated on the map, referred to in the paragraphs on the Queens waterfront of Jamaica Bay, consists of a main channel 1,000 ft. wide paralleling the shores of the bay with numerous basins extending considerable distances inshore from that channel, but the city has a tentative plan for the construction of six piers just southerly of Mill Basin and easterly of an extension of Flatbush Avenue. The location of these piers and of the various channels and basins of Jamaica Bay is shown on Type VII of "Suggested Plans;" the details of the piers themselves are shown by Type VIII. The Commission suggests canalization and gradual development for this section.

Here, too, as at Hackensack Meadows and Newark Bay exists the possibility of the cheapest form of harbor development. The dredging of the slips and channels can be utilized to form the necessary piers and uplands, requiring only the construction of bulkheads to retain the excavated material, and providing for a development that can start small and expand as the business demands.

There is a possibility, some time in the future, of 1,000-ft. piers in Gravesend Bay, to be served by an extension of the Jamaica Bay waterfront belt line running along the proposed canal between Gravesend Bay and Sheepshead Bay, which canal will ultimately provide safe access to Jamaica Bay for small craft. The Gravesend Bay piers, however, will probably not be practicable until a suitable breakwater has been constructed so that shipping at the piers will not be menaced by the waves of the Lower Bay.

CHAPTER 16

Railroad Belt Lines and Consolidated Marine Service

Besides relieving the Manhattan waterfront of all railroad pier stations, the automatic-electric system, if in operation in 1914, would have eliminated 7.17 per cent of the tonnage handled through the waterfront yards of the New Jersey roads on the westerly shores of the Hudson River and Upper Bay, and 16.13 per cent of that handled by the New York roads at their waterfront yards. This would have left 92.83 per cent of the New Jersey roads' waterfront tonnage and 83.87 per cent of that of the New York roads to be handled as at present, by standard-equipment car, locomotive, car float, lighter and truck. These units and the present system of operating them are better adapted at present to freight distribution in the districts surrounding Manhattan Island than the automatic-electric system would be. The service should, however, be consolidated for two reasons — (1) to release to commerce waterfront now used by the railroads and (2) to effect economies in operation.

Consolidated Marine Service

Consolidation can best be accomplished by joint marine service,. and joint receiving and forwarding stations on the waterfront for car-float operations and for lighterage, separated from each other sufficiently to prevent undue congestion on either the land or water side. Such stations would not be effective unless served by belt lines common to all railroads. The waterfront released to commerce would not be fully effective unless served by such belt lines. Waterfront now used by the railroads for effecting interchange can also be released by the belt lines.

Most of the waterfront yards in New York and New Jersey occupy shore frontage immediately adjacent to deep water and highly desirable for the uses of commerce. The joint car-float and lighterage stations can be established on shallower waters and less desirable waterfront, and because of the elimination of duplication will occupy less frontage than at present serves such purposes.

A joint car-float station and a separate joint lighterage station are suggested for the New Jersey roads. A joint lighterage and two car-float stations should be established for the New York roads. All of these stations should be separate and distinct from the existing car-float service from Greenville, Jersey City, operated by the Pennsylvania Railroad.

Consolidation of marine service should include not only consolidation of the receiving and depatching stations at the railheads, but consolidation or pooling of the marine equipment. This, by making the entire combined fleet of tugs, lighters, car floats and other harbor craft available wherever needed, should make it possible to eliminate a considerable amount of duplication and reduce the fleet. It should also be possible to consolidate the repair facilities and operate them more economically.

Consolidation of the car-float service will be especially beneficial to the private terminals. At present they receive cars from and deliver them to various yards up and down the waterfront. Reducing the number of points of receipt from and delivery to the railroads to about three will tend to eliminate the movement of under-loaded car floats.

Shippers using the private terminals will also be benefited. At present, to avoid sending out car floats with only one or two cars for a railroad, freight is held until several cars can be loaded — sometimes a matter of days. If delivery can be made at one point to a number of railroads these delays can probably be avoided.

It may be preferable even with the joint operation for the railroads having individual pier stations in Long Island to retain them. Consolidated service, however, will make it possible to establish joint stations in outlying districts where the tonnage is not sufficient to warrant individual stations.

Consolidation of lighterage terminals will be especially beneficial to steamship lines for much the same reason cited in the case of car-float service to and from the private terminals. At present a steamship's cargo may have to be collected from all of the railroads and all of their waterfront terminals. The whole process will be greatly simplified if all of the rail-to-ship tonnage can be received from one lighterage station in New Jersey and one in New York.

At these joint lighterage terminals adequate space will naturally be provided for handling structural steel and other rail-borne building materials. Only two or three of the railroads have adequate space at present, and the entire building trade as well as the other railroads suffer from the lack of proper facilities.

Belt Lines

Two sets of belt lines are needed in New York, and three in New Jersey, as follows:

Inner or waterfront belt lines in New York and New Jersey close to the shore lines, mainly for serving the steamships and industries of the waterfront.

Middle belt lines in New York and New Jersey, located between the break-up yards of the railroads and the waterfront, for the service of the joint car-float and lighterage stations and also to effect interchange between the railroads.

An outer belt line in New Jersey only, still more remote from the waterfront and outside of the break-up yards but connected with them and with the middle and inner belts, for handling such water-borne and interchange tonnage as can, by classification at the nearest divisional yards of the railroads or by direct haul from the break-up yards, be delivered to it in solid train lots, and thus be kept out of the congested district. Later on the outer belt line in New Jersey will also be necessary for the relief of the middle belt line in New Jersey, which, if the present ratio of increase in tonnage is maintained for the next decade, will by that time be crowded to capacity. By the time this shall have occurred additional break-up facilities will have to be constructed, and they can properly be built at the junctions of the various trunk lines of New Jersey, making the outer belt effective for all services.

Inner or Waterfront Belts

Virtually every foot of possible deep-water frontage in the Port, with the exception of that in Manhattan, should ultimately be served by marginal railways. Manifestly it is not possible to build them all at once. They should be developed in their economic sequence, the determination of which sequence will require more extensive study than the time allotted to this Commission enabled it to complete. This is therefore a matter to be left to some succeeding authority, such as the recommended Port Authority, which, with the aid of the various communities, can readily solve it.

Following the belt-line principle and without regard to ultimate sequence, the Commission suggests inner belt lines paralleling: The easterly shore of the Upper Bay and the East River; the westerly shore of the Upper Bay and Hudson River; the northerly shore of Jamaica Bay; the westerly shore of Newark Bay; the easterly shores of Newark Bay and the Jersey City section of the Hackensack River; the easterly shore of the Hudson River in the vicinity of Yonkers; the southerly shore of Newtown Creek; the westerly shore of the Narrows; the southerly shore of the Kill von Kull; both shores of the Arthur Kill; the northerly shore of the Raritan River; the northerly shore of the Borough of Queens, and the southeasterly shore of the Borough of the Bronx.

All of these belt lines should be connected to the middle and outer belt lines as indicated on the comprehensive plan. The functions of some of these inner belt lines, as well as their more precise location, are discussed more intimately in Chapter 23, on the development of other sections of the Port.

Middle Belt Lines

While the purposes of the middle belt lines in New York and New Jersey are apparent, the precise location of the line in New Jersey is not so well determined. It should extend from a connection with the New York, Susquehanna & Western Railroad near Little Ferry on the north to a connection with the Central Railroad of New Jersey in the southerly part of Bayonne. Beginning at the northerly end, it should probably run as nearly as possible parallel and adjacent to the New York, Susquehanna & Western Railroad, the Northern Railroad of New Jersey and the steam belt line of the proposed automatic-electric system. For a short distance it should utilize the bed of the Morris Canal through Bayonne, and its southerly end should parallel the Central Railroad of New Jersey. It should connect with all of the New Jersey roads—the Philadelphia & Reading and the Baltimore & Ohio via the Central Railroad of New Jersey, and the New York, Ontario & Western via the West Shore. Ultimately an extension at the north end under the Bergen ridge to Fort Lee would probably be desirable.

The middle belt line on the east side of the Hudson River and Upper Bay will run from Bay Ridge, Brooklyn, along the rails of the Long Island Railroad and the New York Connecting Railroad to junctions with the New York Central Railroad and the New York, New Haven & Hartford in the Bronx. It will be connected with the outer, middle and inner belt lines of New Jersey by car ferry until such time as tunnels become practicable.

Outer Belt Line

The outer belt line on the westerly side of the Hudson River and Upper Bay will extend from Piermont, N. Y., to Newark Bay, with extensions and termini at Elizabeth, Bayonne, the Raritan River and the east shore of Staten Island.

The Commission early in its deliberations deemed this line important enough to warrant a survey to determine its practicability, and inasmuch as the State Engineer and Surveyor of the State of New York had the nucleus of a field force for surveys, whereas the Commission would have been compelled to create a special force not easily adaptable to its other work, an arrangement was made to have the work done by the State Engineer's forces under the direction of the Commission. Reconnaissance surveys having been made, the shortest practicable route was adopted, which for a considerable part of the way follows a line proposed by Mr. Irving T. Bush some years ago.

In October, 1918, two field parties were organized to make preliminary and location surveys. The first started at Piermont and worked south. The second began at Springfield (east of Summit) and worked north. The parties came together in January, 1919, and early the next month one was disbanded while the other worked east from Springfield to Great Island, a point on the Newark-Elizabeth line of the Central Railroad of New Jersey in the northern part of the city of Elizabeth. The main field work was completed in February, 1919, and two additional months were devoted to topographical surveys for railroad crossings and interchange tracks at the various junctions with the Jersey roads, and to estimating and mapping.

Obviously the time devoted to this work was not sufficient to determine, in every detail, the best location of a line of this length and importance. At the time the work was undertaken the study of the general problem had not proceeded far enough to indicate the location of the southern termini.

The Commission has since decided that the line should continue from Great Island under Newark Bay to a terminal in Bayonne and ultimately under the Upper Bay to a junction with the New York Connecting Railroad; also that branch lines should be run to the Raritan River and under the Arthur Kill to a connection with the Staten Island Railroad on the southeasterly shore of Staten Island near Fort Wadsworth. These branches and extensions as well as the various line revisions will require more detailed study by a permanent Port Authority.

GENERAL LOCATION

The line as laid out is approximately 45 miles long, extending from Piermont on the Hudson to Great Island. The line takes a southwesterly direction from Piermont to a point near Summit, and then turns east to Great Island. It passes just west of the city of Paterson and west of the Orange Mountains.

It has no curves sharper than four degrees and its ruling gradient is 0.6 per cent, compensated at 0.04 per cent per degree of curvature in accordance with standard railroad practice. It has two tunnels, one 3,400 ft. long and one 6,000 ft. long, and avoids all grade crossings, either of other railroads or of highways.

The location is well beyond the congested districts and outside of the break-up yards except at the southerly end, where it is north of the Elizabethport yard of the Central Railroad of New Jersey and the Arlington yard of the Baltimore & Ohio.

Heavy work is encountered on the northerly end of the line, as it crosses the drainage, but the location avoids costly right-of-way and its junctions with the various New Jersey railroads are on easy grades with ample room for any yards that may become necessary in the future.

Its tunnels are straight and on uniform grades, involving no difficulties of drainage or ventilation. The Hawthorne tunnel will pass through red shale, sandstone and trap rock. The tunnel at Summit will be partly at least through glacial drift, but to what extent can be determined only by borings which remain to be taken. Ample room for yards and shops is available at many points, and throughout its length excellent sites are available for industries.

USES OF OUTER BELT

This belt line will find one of its principal uses in direct trainload interchange of freight between cars and ships. Being well beyond the present yards, trains made up entirely at interior division points of goods for export will be diverted to the belt line at the intersection with the originating road, and will be spared the delays in passing through the break-up yards and the congested sections of track between those yards and the waterfront. A large classification yard, to which the middle and inner belt-line systems in New Jersey will also have direct access, will be built near one of the southerly termini of the outer belt line. The belt line will afford direct connection to the modern steamship terminals for freighters that will naturally be built at the termini of the line, while the inner and middle belt-line systems will give the entire New Jersey waterfront the same opportunity for direct rail service. Solid trains of imports can be made up at the belt-line yard or at points on the inner-belt system and despatched via the outer belt direct for points on any of the trunk-line railroads of the Port.

Another important use of the line will be for bulk interchange between the New York State Barge Canal and the New Jersey railroads. An adequate Barge Canal terminal should be built at Piermont, and it is believed that an extensive traffic will be developed between the canal system and the railroads, principally the roads running to the south.

A grain elevator at one of the southern termini of the exterior belt line is recommended by the Commission in its discussion of the handling of grain, and trainloads of grain will naturally be run through direct to this elevator via the belt line. Another elevator is proposed at Piermont.

Car-float service can easily be inaugurated across the Hudson River from Piermont, connecting with the main line of the New York Central, and if desired with joint pier stations and float-bridge terminals at the various communities in the vicinity. This will give Yonkers, Hastings, Dobbs Ferry and the neighboring towns direct access to the New Jersey railroads, besides closing the belt-line loop via Spuyten Duyvil and giving the New York railroads easier access to northern New Jersey.

The belt line will obviously open up new territory for industrial development well beyond the present congested district, and in the course of time it should provide a considerable amount of local business.

EXTENT OF WATERFRONT RELIEF

As previously stated, the automatic-electric service, if in operation in 1914, would have relieved the New Jersey waterfront yards of about 7 per cent of their railroad tonnage and the New York waterfront yards of about 16 per cent. The creation of joint car-float stations on territory not now occupied by any of the railroads would have relieved the New Jersey waterfront yards of about 19 per cent and the New York waterfront yards of 71 per cent of their tonnage. The creation of joint lighterage stations to handle all lighters except coal, grain and live stock, similarly on territory not now in railroad use, would have relieved the New Jersey roads of 10 per cent and the New York roads of 3 per cent of their tonnage. The middle belt line would have relieved the New Jersey roads of about one per cent of interchange that was handled by car float between the New Jersey railroads.

Besides the foregoing, about 13 per cent of the waterfront tonnage of the New Jersey roads and 9 per cent of that of the New York roads was delivered to or despatched from upland stations, remote from the waterfront, or was delivered to other railroads by rail, and could consequently have been carried on without using the waterfront.

To sum up, the waterfront tonnage of the New Jersey railroads would have been reduced by about 37 per cent and that of the New York railroads by 90 per cent as the result of the belt lines, the automatic-electric system and the consolidation of service, and the inclusion of the 13 per cent of New Jersey road tonnage and 9 per cent of New York road tonnage not requiring waterfront service would have reduced the necessary tonnage at existing waterfront yards to 50 per cent for the New Jersey roads and 1 per cent for the New York roads, this consisting of lighterage of coal, grain and live stock and other bulk commodities. The reduction of the lighterage of the New York roads to such small proportions is based on the assumption that the logical route for the New York Central traffic is via the West Shore Railroad, facilities being provided east of the Hudson, presumably on the upper East River, mainly for that originating east and south of Albany. The New York, New Haven & Hartford Railroad has little lighterage.

CHAPTER 17
Trucking

A most important element in the distribution and collection of freight at the Port of New York is the street truck. To enable the Commission to plan intelligently for efficient use of this element, a knowledge of the conditions and facts controlling its operation was requisite. The elimination of congestion and delays at the store, the freight terminals and the warehouse and on the street means money and comfort to the public, the truckman, the railroad, the steamship company, the warehouseman, the merchant and the manufacturer. Equally widespread will be the benefit resulting from the reduction of trucking distances and the increasing of loads more nearly to the capacity of the vehicle.

To get light on the conditions of the trucking industry from every angle interviews were obtained with truckmen, merchants and freight agents; formal questionnaires were sent to truckmen and merchants; one-hour truck-census studies were made at freight terminals, freight piers and warehouses and on city streets for the purpose of ascertaining the character and peculiarities of the traffic and ways of betterment; twelve-hour clockings were made at street intersections to determine the street capacities at those points; twelve-hour clockings were made at each railroad freight station, pier or inland; twenty-four-hour clockings were made at each ferry on the Hudson and East Rivers to determine their carrying capacities; time truck studies were made of the operations of horse-drawn and motor-driven trucks, in which men rode with the trucks all day, recording the distances traveled, loads carried and distribution of the time.

Some of the savings possible through improved conditions affecting the operation of trucks can possibly be neither capitalized nor computed. All should nevertheless be taken into serious account in considering the plans recommended by the Commission. The saving possible when the automatic-electric system for Manhattan is in operation through merely eliminating delays at stations and reducing lengths of haul, irrespective of the possibility of larger truck loads and other economies reasonably to be expected, will, it is estimated, amount to nearly $2,800,000 annually on the basis of the tonnage the system is expected to handle in 1929 — and $2,800,000 is the interest at 6 per cent on $46,666,667.

General Conditions

An association known as the New York Team Owners' Association did effective work in the New York tailboard cases some years ago. Since then it has been less active, and the trucking industry has proceeded with little direction. Methods which prevailed during the latter part of the nineteenth century are still in vogue. Destructive competition is responsible for some of the evils, ineffective organization for others, poor design of terminals and limitations of the ferries for still others. The merchant blames the driver, the truckman, the railroad, the steamship company, the ferry and the warehouseman for delays. The railroads, the steamship company and the warehouseman blame the merchant, the driver and the truckman. The truckman blames the driver, the railroads, the steamship companies, the ferries, the warehouseman and even the merchant. The driver blames everybody.

To a certain extent all of the complainants are justified. All contribute to the general chaos. The railroads and steamship companies are trying to do business at terminals unequal to the demand put upon them, and great congestion results. The merchant, even though he may own and operate his own trucks, subordinates his trucking economies to the desire for quick delivery over main thoroughfares, and turns over all his business at congested points to the truckman. The truckman, driven by destructive competition, is unable to wait for full loads and usually has a great deal of empty mileage. He has no uniform system of cost keeping, no follow-up system to eradicate evils. The driver, encouraged to slovenliness or discouraged from industriousness by the congestion at all points, contributes to it by loafing and increasing his overtime.

These are generalities, to which there are of course many exceptions. But they are typical, and for them all the public must pay. And the conditions are not improving, while the costs are increasing annually.

There seems to be only one cure — a central authority and control, from proper organization of public or private interests, or of both. At the time this report is being written an effort is being made to consolidate twenty-seven representative trucking companies operating in the City of New York. It is expected that the consolidation will effect many economies — such as the elimination of many foremen at terminals, consolidation of loads to and from individual terminals on a smaller number of trucks, and the saving possible from the installation of loading equipment. The step has great promise if intelligently executed.

Classification of Trucks and Truck Service

A starting point for the trucking investigation is an examination of the kinds of trucks in service and the kinds of service performed. A general idea of the relative numbers of the different kinds of trucks in service was obtained from a truck census taken at points of heavy traffic, and from a questionnaire addressed to the truckmen. The truck census shows that of 2,172 vehicles observed in the Borough of Manhattan, 72.7 per cent were horse-drawn, 25.8 per cent were gasoline-driven, and 1.5 per cent had electric drive. The questionnaire, covering 5,378 vehicles, shows 67.8 per cent horse-drawn, 23.4 per cent gasoline-driven and 8.8 per cent driven by electricity. As the questionnaire included a large number of express company trucks, it naturally shows a higher percentage of motor trucks than the census does.

Forty-five per cent of the trucks covered by the truck census, it may be said in passing, had city licenses. Other less important facts developed by the census and questionnaire are not presented, although they have been of use in the work of the Commission.

FOUR GENERAL CLASSES OF TRUCKING

There are four general classes into which trucking may be divided: (1) "General trucking" or truck livery; (2) restricted "pick-up and delivery" business; (3) small pick-up or trucking express business, and (4) freight "transfer business."

General Trucking or Truck Livery—The general truckman or truck liveryman owns many horses and trucks, sometimes several hundred, and hires others from small operators as his needs may require. He maintains a large stable, regularly employs a veterinarian, and may employ a superintendent or foreman on whom he depends for initiative and responsibility.

He is a specialist in large-scale operation. He rents his trucks by the day or week at prices the man with small capital cannot meet. He has not, however, a fixed scale but charges "all the traffic will bear." He keeps jealous watch of his competitors, and of the prices they pay for hay and oats. He keeps in touch with small operators who occasionally have trucks for rent, and his establishment becomes a clearing house and an agency for his neighborhood. He is an expert in handling special lines of merchandise between piers, railroad stations and warehouses, and his trucks are often identified with business houses of standing, whose names frequently appear on his trucks.

He neither loads nor unloads commodities on his premises, but he assumes personal responsibility for the safety of goods in transit, perhaps taking the risk of moving $100,000 worth of silk on an open truck with only the driver to guard it. He frequently bears the expense of thefts of packages from trucks and even the loss of entire loads of merchandise.

This truckman is a man of large interests and responsibilities, and would find it impossible to give his own personal attention to the minute details of his business.

Drays at an Outbound Section of a Pier Station Where Bulkhead Shed Is Too Narrow to Permit Successful Consolidation of Trailer Loads or Make-Up of Trailer Trains

Restricted Pick-Up and Delivery—The truckman engaged in the restricted pick-up and delivery business owns a relatively small number of one-horse and two-horse trucks. He must have one or more trucks available, renting them when business is slack. He may maintain a stable or board his horses. He may or may not have room on his premises for the unloading, classification and reloading of freight. He may work for only a few customers whose establishments are within a small radius of his office, or he may work exclusively for a single customer, and maintain his office in that customer's place of business.

He does not accept miscellaneous business outside of his regular line. He is able to give better service to a few than to many. His close relation to one or more reputable firms reduces his risks, and he is able to get lower rates for insurance. His few customers set their outgoing freight on the sidewalk each morning, and his truck picks it up at his convenience and delivers it to its destination. By this method rehandling is avoided, feeder trucks are not required and the risks are lessened because his drivers do not enter the customers' stores.

He frequently charges 75 cents a case, with additions for longer distances. He may develop his business in a considerable field, and have more than one office, and yet beyond a certain number of customers and a certain line of commodities he does not go.

Small Pick-Up or Trucking Express—The small pick-up or trucking express business is represented by the man who perhaps owns only one truck and one or two horses, and may be his own driver. In no instance does he own many trucks or employ many men. He has a small office or stand, and takes whatever business may come. He picks up and delivers one or many packages on any route to any destination. His business differs from the express business in that he does not carry small parcels of value because of the danger of loss from his open unprotected truck. He cannot solicit the regular trade of many companies because he has not sufficient capital to be held responsible in case of a large loss. He cannot compete with the larger operator because, although his rates may be lower, his standard of service and degree of responsibility are also at a low level.

Freight Transfer—The freight transfer business is an activity closely allied to the transportation companies and controlled by contract. It consists of the transfer of freight from the terminals of one common carrier to those of another or between the terminals of a single carrier. A considerable amount of freight is trucked from one pier station to another of the same railroad in Manhattan in order to consolidate it into full carloads and avoid the necessity for doing this at the transfer platforms in New Jersey. This process adds to the congestion in the city streets and will be eliminated when the system recommended by the Commission is in operation.

Trucking plays a large part not only in the getting of goods into, out of or through the Port, but also in local transfer within it. Besides the haul from the railroad or steamship terminal to the store or factory or in the opposite direction, there is much trucking from store to store, from wholesaler to retailer, from factory to warehouse, over which the Port Authority can have little control, and which if inefficiently performed will cause congestion throughout the business section of the Port in spite of the most carefully planned terminals and terminal operations.

ROUTES AND STREET CAPACITIES

Interviews and questionnaires indicate that the most favored north-and-south routes in Manhattan for trucking are West, South, Hudson and Lafayette Streets and Eleventh, Eighth, Sixth, Fourth and Park Avenues, while the most favored streets for east-and-west traffic are Pearl, Fulton, Chambers, Canal, Thirteenth, Fourteenth, Twenty-third, Thirty-third, Thirty-fourth, Thirty-fifth, Thirty-seventh and Forty-second Streets, and Park Row. The bridges over the East River carry a heavy trucking traffic, as do the ferry to and from Staten Island and a number of the railroad ferries on the Hudson River, particularly the Cortlandt and Desbrosses Street ferries of the Pennsylvania. Streets mentioned as especially congested are Duane, Reade, Franklin and Fulton Streets and the streets of the lower West Side primary market district in general.

Opinions elicited from truckmen and merchants as to the best types of pavement indicated a preference for granite blocks. Lafayette Street was cited by many as being the best paved street in New York City. Condemnation of asphalt and wood-block pavement was almost unanimous. The majority of truckmen favored restricted streets.

Drays at an Outbound Section of a Pier Station Where Bulkhead Shed Is of Sufficient Width for Consolidation of Loads on Trailers and Make-Up of Trailer Trains

For the purpose of ascertaining the number of trucks per hour which could arrive at and depart from an inland freight station with a minimum of street congestion, traffic counts were made at various busy street intersections. The data contained were not sufficiently complete to be conclusive in themselves, but were valuable as a check on the driveway capacities used for the design of the terminals.

Fig. 1 shows graphs of a 10-hour count at the intersection of Broadway and Chambers Street. It indicates for each hour the number of through trucks passing in each direction on Broadway and in each direction on Chambers Street, and the number arriving from either direction on either street and turning in either direction into the other.

The through north-and-south traffic on Broadway includes street cars. While the field record divides the vehicles into street cars, horse trucks, motor trucks and pleasure vehicles, the graph does not make such a separation, as it has no bearing on the purpose for which the studies were made.

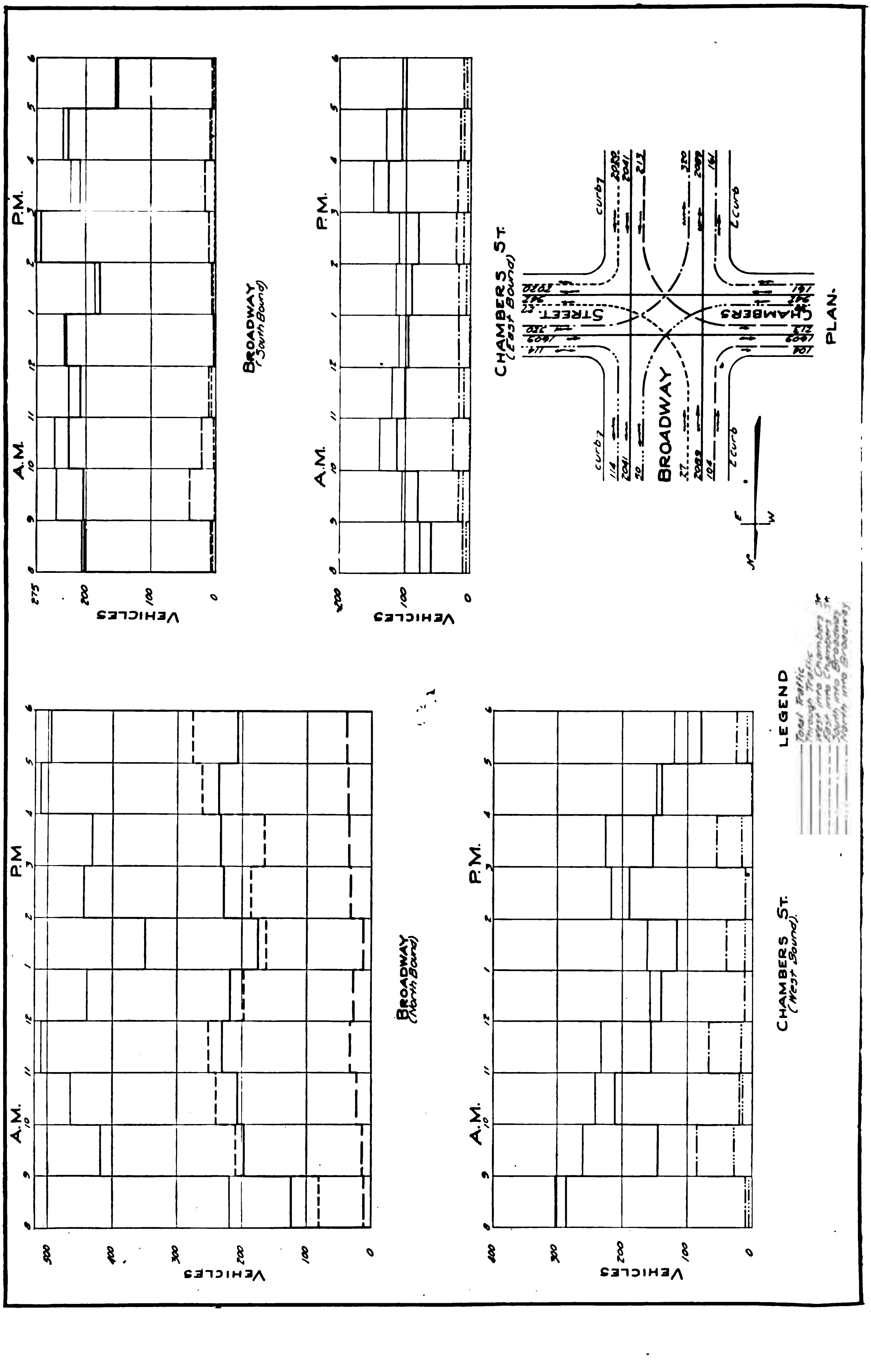


FIG. 1—Graphs of a Ten-Hour Count of Vehicle Traffic at the Intersection of Broadway and Chambers Street, New York City

Truck Licenses and Service Charges

Three classes of licenses are issued to cover the operations of commercial trucks in the City of New York, where the trucking problem centers. A state license is necessary for all motor trucks and other motor vehicles; a city license is required for trucks in commercial service, whether horse-drawn or motor-driven, and a custom-house license must be obtained for trucks handling bonded goods. The drivers of the customs trucks must be able to read, write and speak the English language, and while on duty their trucks are under the supervision of the custom-house office.

NEW YORK STATE LICENSES

Motor vehicles in New York State used for the transportation of goods, wares or merchandise must have state licenses at prices that vary with the combined weight of the vehicle and its capacity load. Where this sum is 2 tons or less the fee is $10; more than 2 and not more than 3 tons, $15; more than 3 and not more than 4, $20; more than 4 and not more than 5, $25; more than 5 and not more than 6, $30; between 6 and 14 tons, $5 for each ton above 6 tons; above 14 tons, $10 for each additional ton.

For pleasure cars a sliding scale based on horsepower, list price and year of manufacture is in force. To a flat fee of 25 cents per horsepower is added 40 cents per $100 of the manufacturer's list price if the car was made in 1917, 1918, 1919 or 1920, 20 cents per $100 if it was made in 1915 or 1916, and 10 cents per $100 if it was made in or before 1914.

Omnibuses for carrying passengers for hire are licensed at $15 per year if they carry five passengers or less, from $24.50 to $67.50 if they carry from six to thirty passengers, and $2 per passenger for each in excess of thirty passengers. Omnibuses operating under a franchise, however, are licensed at $10 per year.

NEW YORK CITY LICENSES

New York City licenses are covered by Article II — Public Carts and Truckmen — of the Code of Ordinances of the City as amended in 1919, Sections 140–144. "Every vehicle of whatever construction," states the ordinance, "whether drawn by animals or propelled by any motor power, which is kept for hire or used to carry merchandise, household, office furniture or other bulky articles within the city, for pay, shall be deemed to be a public cart, and the owner thereof shall be deemed to be a public cartman." Public carts are divided into four groups as follows:

A — Carts drawn by one horse and having an inside floor surface of at least 40 square feet.

B — Carts drawn by two or more horses and having an inside floor surface of at least 70 square feet.

F — Motor-driven carts having an inside floor surface of at least 70 square feet.

G — Motor-driven carts having an inside floor surface of at least 90 square feet.

"In all of the above measurements," states the ordinance, "a variation of more than 5 per cent shall not be accepted."

The license fees of the horse-drawn vehicles, classes A and B, are $2 per year. Those of the motor vehicles, classes F and G, are $5 per year.

Section 144 — Charges — provides a general scale of rates as follows:

Class A vehicles, when propelled at not less than three miles per hour, $1.25 per hour.

Class B vehicles, when propelled at not less than three miles per hour, $1.50 per hour.

Class F vehicles, when propelled at not less than eight miles per hour, $1.75 per hour.

Class G vehicles, when propelled at not less than eight miles per hour, $2.50 per hour.

For the service of each man in addition to the operator or driver, 50 cents per hour — the number of additional men not to exceed three except when specially agreed upon by the person hiring the carts.

In lieu of this general scale a special contract may be agreed upon in advance, in which case the public cartman must furnish the person with whom he contracts a written memorandum to be signed by both parties or their responsible and authorized representatives, setting forth clearly the terms of the contract.

All disputes as to the rate or amount of compensation, the ordinance provides, are to be adjusted by the officer in charge of the police station nearest to the place where the dispute is had.

SERVICE CHARGES

Actual service charges often bear little relation to the legal rates fixed by the above-mentioned ordinance; nor is there any uniform system of charges. In general the rates vary from 4½ to 5½ cents per hundredweight for carload freight, and from 50 to 75 cents per package, irrespective of weight, for general merchandise. Paper cartage has been found to vary from $1.50 to $4.50 per load. Rentals for horse-drawn trucks varied in 1918 from 83 cents to $2.75 per hour, and from $40 to $55 per week, according to the number of horses. Rates for motor trucks ranged from $1.50 to $5 per hour, according to the capacity of the truck. In short, what is paid for trucking varies with the volume and desirability of the business, and truckmen charge what the traffic will bear.

Trucking Costs

Trucking costs are difficult to arrive at accurately for the reason that there are so many varying factors and so little effort on the part of truck operators to keep full account of their costs. Estimates based upon figures obtained from a number of sources indicate that it costs about $1.80 per hour to operate the average two-horse truck in railroad pier-station service, where horse-drawn trucks predominate, and about $3.25 per hour to operate the average five-ton motor truck over greater distances, as between Manhattan and the Bronx or New York and Newark, where, because of the longer runs and small percentage of idle time, the trucks are more economically justifiable than in the short-haul service within lower Manhattan.

The figures are the basic costs irrespective of whether the truck keeps moving a good part of the time, and irrespective of whether it carries full loads or runs empty. These questions have a very large bearing on the cost per ton.

HORSE-DRAWN TRUCKS

The elements of cost for horse-drawn trucks are few, and require no complicated system of bookkeeping to determine and utilize them, either in conducting the business or making the rates. They consist of stable expenses, board and shoeing of horses, veterinary service, repairs to trucks, wages of drivers and helpers, licenses, insurance, interest on investment, depreciation and general administration.

Interest on investment seems to be quite generally neglected as an item of cost. Obviously it should be taken into account. Depreciation is a charge made necessary both by wear and tear and by obsolescence and should cover the useful life of the trucks and horses, but should not be carried below the scrap value or selling price at the end of the depreciation period. General administration should include all charges for management or supervision, and all office expenses, including office salaries, rent, heat and light — items pertaining to the general oversight of the business.

It is urged that accounts be so kept as to show the cost of each detail of the business — the cost of moving with full loads, with part loads and with no load, the costs separately of delays at terminals, stores and warehouses, and the losses sustained by idling on the part of the drivers.

Daily costs were obtained as of the year 1919 on nine two-horse trucks as follows: Three contract trucks, $8.85, $8.50 and $13.88 per day respectively; one merchant-owned truck, $14.13 per day; and five trucks owned by general truckmen, $12.85, $10.23, $13.91, $15.58 and $11.59 per day. These costs are for eight-hour days and do not include ferriage, overtime or helpers in loading and unloading. The contract trucks were trucks rented to merchants by truckmen, and the daily costs do not include the overhead of the merchants. Otherwise the figures given cover feed, shoeing and veterinary service for the horses, repairs to trucks and harness, wages of drivers, stable rent, light and help, licenses, insurance, interest on investment, depreciation on horses, trucks and equipment, and general administration.

Undoubtedly the variation of costs is due largely to the variation in the classes of business handled. Some classes require more supervision than others. Higher insurance has to be carried by some trucks, and some perform more work than others, which increases the operating cost per day though it reduces the cost per ton. The truckman should know exactly where his leaks are in order to be able to minimize his costs and obtain the greatest profit. Many of these leaks can be detected only by comparison with previous records. Constant watchfulness and application of the facts as shown by the books are necessary for efficiency.

MOTOR TRUCKS

The elements of cost for motor trucks follow along similar lines. They include the cost of gasoline or electricity, depending on the motive power, of lubricating oils and grease, tire renewals and repairs, repairs to the chassis and truck bodies, wages of chauffeurs and helpers, garage hire, licenses, insurance, interest on investment, depreciation and general administration.

The best practice figures depreciation either 16⅔ or 20 per cent. Interest is usually taken at 6 per cent. Insurance must cover casualty, theft and fire. These items, together with licenses, garage expenses and wages, are usually figured on a monthly or yearly basis, to which is applied the average number of days per year obtainable from each truck. A fair figure for this, derived from a very large business, is 250 days per year.

Gasoline, lubrication, tire renewals and repairs to chassis and truck bodies are usually figured on a mileage basis.

General administration is best figured as a percentage applied to both groups of costs.

Typical costs for a 5-ton gasoline truck appear in Table 1. They are composite figures, made up from such records of the American Railway Express Company and statements obtained from the Pierce-Arrow Motor Company as are thought most nearly to approximate average conditions at the Port. They are believed to be reliable as of the years 1917 and 1918. The wages of the chauffeur, in the group of costs that is irrespective of mileage covered, are based on an 8-hour day.

TABLE 1 — APPROXIMATE OPERATING COSTS AT 1917 AND 1918 PRICES OF 5-TON GASOLINE MOTOR TRUCKS

Item	Cost per year
*Interest on investment at 6%	$378 00
*Depreciation at 16⅔%	1,049 58
Insurance	501 17
License	50 00
Garage	513 96
Chauffeur	1,664 00
	$4,156 71
General administration, 10%	415 67
Total per year of 250 operating days	$4,572 38
Cost per day	18 29
Direct Operating Costs, on Mileage Basis	
Item	Cost per mile
Gasoline	$0.0682
Lubrication	.0058
Tires	.0611
Repairs	.0619
	$0.1970
General administration, 10%	.0197
Total per mile	$0.2167

* Based on a first cost of $6,300, including war tax.

Daily costs that embrace the items dependent upon the mileage have been built up from figures obtained from eight operators of 5-ton gasoline trucks, and are presented in Table 2. The table includes the average mileage for most of the trucks. The figures are 1919 costs.

TABLE 2 — ESTIMATED TOTAL DAILY OPERATING COSTS AT 1919 PRICES OF 5-TON GASOLINE TRUCKS

Line of business	Daily mileage per truck	Cost per day per truck
A — Department store	85	$24 55
B — Wholesale drygoods	27	19 00
C — Grocery chain stores	37	25 52
D — Wholesale produce	..	27 18
E — Public service corporation	..	25 00
F — General trucking, railroad transfer	40	28 00
G — General trucking	30	24 23
H — General trucking	50	28 56

Operator A uses a truck between its New York store and a New Jersey distribution station, making one trip per day. The truck carries a chauffeur and a helper. The company employs its trucks to give service and charges part of their cost to advertising; hence it is not particularly interested in the item of operating cost, and could not give very definite figures. To its estimate of $20.19 for the actual cost of operation were added figures for interest on investment and depreciation. The company was unable to give insurance charges or any of its general administrative charges.

Operator B operates a truck primarily between New York, its Brooklyn factory and its New Jersey factory. The cost of $19 per day includes wages of chauffeur and helper, gasoline and oil, garage rental, insurance, state license fee, interest on investment and depreciation. The company was unable to give any estimate of the general administrative charges.

Drays and Temporary Storage of Goods on Marginal Way in Front of Sound Line Piers —Hudson River, Manhattan

Operator C has a fleet of trucks of various sizes and keeps very complete cost records. The 5-ton trucks operate between the company's warehouse and its stores. The cost of $25.52 includes chauffeur's wages, gasoline and oil, tires, repair material and parts, garage expenses, insurance, state license fee, interest, depreciation and general administration.

Operator D operates trucks between New York piers and Wallabout Market in Brooklyn, and at times also does some trucking for other merchants in the same line of business. No record of mileage is kept. The cost figures include wages of chauffeur and helper, gasoline, oil and grease, repairs, garage rental, insurance, state and city license fees, interest, depreciation and general administration.

Operator E, a public service corporation, declined to give any details as to its figure of $25 per day for operating a 5-ton truck.

Operator F divides its figure into chauffeur's wages, gasoline, oil and grease, tires, repairs, garage rental, license fees, insurance, interest, depreciation and general administration.

Operator G includes in its figure wages of chauffeur, gasoline and oil, repairs, license fee, insurance, interest, depreciation and general administration, plus 20 per cent for lost time due to repairs, lack of work, bad weather or other causes.

Operator H operates large fleets of trucks in New York as well as in other localities, and, unlike the other truckmen, has motor trucks only. Its costs are built up on substantially the same basis as those of Operator G, with the 20 per cent allowance for loss of time.

The foregoing costs are based on 8-hour working days, and do not include any overtime to chauffeur, or any charges for loading or ferriage.

Application of the mileage of Operator A to the cost

Use of Marginal Way for Open Storage, Protected with Tarpaulins, of Freight for Steamships

totals of Table 1 gives $25.89 per day as against $24.55 in Table 2. The operator made no allowance for insurance charges or general administration, however, and the elimination of this, amounting to about $1.46 per day, would reduce the figure of $25.89 to $24.43 as compared with $24.55.

In the same way the combination of the figures in Table 1 and the mileage in Table 2, omitting general administration to make the figures comparable, would make the daily costs of Operator B $21.47 as compared with $19 shown in Table 2. Similarly, Operator C's costs with the general administration included would figure $26.30 as compared with $25.52 shown in Table 2; those of Operator F would be $26.97 as compared with $28; those of Operator G, $24.87 as compared with $24.23, and those of Operator H, $29.14 as compared with $28.56. No comparison can be made in the case of Operators D or E, because no mileage figures are available.

Despite the rather close coincidence of the typical costs of Table 1 with the actual costs obtained from the operators, it must be recognized that the conditions are bound to vary considerably. No two motors consume the same amount of gasoline per mile, the gasoline consumption varying with different makes of machines and different weights of cars. No two tires of even the same make give precisely the same amount of wear. The personal equation of the chauffeur also enters into the cost per mile. The only way to determine the costs precisely is to keep records over considerable periods for each type and weight of motor truck in service.

Electric trucks have many advantages over gasoline trucks in districts where adequate battery-charging facilities are available, but the Commission has been unable to obtain sufficiently conclusive records to present figures or make definite recommendations respecting them.

Wages of Drivers and Chauffeurs

Bearing heavily on the cost of operating trucks are the costs for drivers and chauffeurs. A complete schedule of the wages in force in the autumn of 1918 is given in Table 3, taken from a form of the agreement entered into by the teamsters' and chauffeurs' brotherhood. This brotherhood was asked by the Commission to furnish the scale of wages in force during the summer of 1920, but it declined to do so.

TABLE 3 — WAGE SCALE OF DRIVERS AND CHAUFFEURS IN EFFECT IN AUTUMN OF 1918

Section 1 comprises a complete weekly wage scale as follows:

Four-horse truck drivers	$30 00
Three-horse truck drivers	28 00
Two-horse truck drivers	26 00
One-horse truck drivers	24 00
Windlass trucks to receive $1 above this wage scale. Night chauffeurs and teamsters to receive $1 per week more.	
Two-horse small delivery wagon driver	$25 00
One-horse small delivery wagon driver	23 00
Five-ton automobile chauffeur	30 00
Four-ton automobile chauffeur	29 00
Three-ton automobile chauffeur	28 00
Two-ton automobile chauffeur	27 00
One-ton automobile chauffeur	26 00

For automobiles of more than five-ton carrying capacity, $1 a ton per week more.

Helpers to receive $22 per week.

Two dollars per week to be paid to chauffeur and helper on every ton carried on a trailer.

Section 2 defines one day's work as follows:

Eight hours to constitute a day's work. Time to be taken when arriving at stable or garage at a. m. and leaving same at p. m. Overtime to be paid at the rate of $1 per hour. First thirty minutes to be conceded to the employers; any time over the half hour to be counted one hour in favor of the employee.

Sections 8–12 inclusive cover:

Sunday and holiday work, stable and warehouse work, employment of union members or prospective members only, appointment of a "stable steward" to oversee the performance of the contract, employment of union loaders and helpers, prohibition of deliveries in buildings, adjustment of deliveries, time of reporting for work, special pay for helping to load trucks other than the one driven, adjustment of agreement after written notice.

Trucking Losses

If trucks could be operated continuously at full capacity, with no one-way empty movements, if they could be kept continuously moving at a safe and proper speed, with only a reasonable allowance of time at stores, warehouses and terminals for loading and unloading, and if the covering of unnecessary distance could be eliminated, the saving would be enormous. The consensus of opinion among truckmen is that idle time amounts to 20 per cent of the total time, whereas individual opinions put the figure as high as 75 per cent. The clockings of the Commission show the average load to be far below the capacity of trucks. The ideal conditions of full load, full time and full speed can of course never be realized, but vast improvements are possible.

The main sources of trucking losses can be classified as follows:

A. Load losses.
   1. Hauling of part loads.
   2. Empty one-way movement.

B. Time losses.
   1. Necessary time for loading and unloading at starting and stopping points.
   2. Unnecessary delays at those points.
      a. Bad design of terminal, warehouse or store.
      b. Inadequate freight-handling machinery.
      c. Inefficient placing of goods at terminal, warehouse or store.
      d. Lack of co-operation between merchants.
   3. Trucking of unnecessary distances.
   4. Idling by driver on streets and at starting and stopping points.
   5. Slow speed in traffic.

The two classes of load losses are similar in kind. With railroad and steamship terminals scattered all along the lower Hudson River and East River waterfronts, and with each merchant or manufacturer depending on his own arrangements for getting his trucking done, there is necessarily a great deal of hauling about of small loads, a great deal of one-way empty movement. Conditions will be greatly improved as far as railroad freight is concerned by the consolidation and zoning of terminals contemplated in the automatic-electric plan. Further improvement is possible by the consolidation of trucking companies and the operation of pick-up and delivery trucks on schedules.

Under time losses necessary time for loading and unloading should perhaps not be regarded as a loss, inasmuch as it is unavoidable. All of the others, however, afford opportunity for improvement. The bad design of terminals and inadequacy of freight-handling machinery at them will be taken care of to a large extent by the new automatic-electric stations to replace the pier stations and the improved steamship piers recommended by the Commission. It will rest with the individual merchants and manufacturers whether they make similar improvements at their own plants.

Improvement in the design of the terminals and their freight-handling equipment will doubtless do much toward promoting more efficient placing of goods within them, but the problem of better co-ordination of effort is a larger one, in that it involves the carrier, the truckman and the shipper or consignee, and especially the truckman and the shipper or consignee. The fullest possible co-operation will mean that the shipper will notify the truckman just when he has goods to be moved, will have them ready when the truckman calls, and will contrive to avoid the most congested periods at the terminals. The carrier will give the consignee notice at the earliest possible moment of the arrival of his goods, and will so place them that they can be readily found and removed when the truckman calls for them. The truckman will make his calls accordingly, and will encounter fewer delays than at present.

The reorganization and consolidation of terminals will likewise materially reduce trucking distances, making it possible for the shipper and consignee to use terminals in his own zone to a large extent, instead of trucking goods up and down Manhattan because the individual carrier cannot handle the goods in his vicinity. The reorganization of the market system recommended by the Commission will also materially reduce the trucking of food products.

Under present conditions, with long lines of trucks waiting at ferries and piers, blockades at important street corners and enforced delays at every point, drivers and chauffeurs have little incentive to make the most of their time, and they contribute greatly to the losses by idling at all points. Reduction of these long delays and general improvement in their opportunities to give good service would doubtless go far toward making them more attentive to their work, while proper follow-up systems and help from the police in serving summonses on willful idlers (such as those who enter ferry truck lines to add to their overtime, with no intention of using the ferry) would further discourage the loafing.

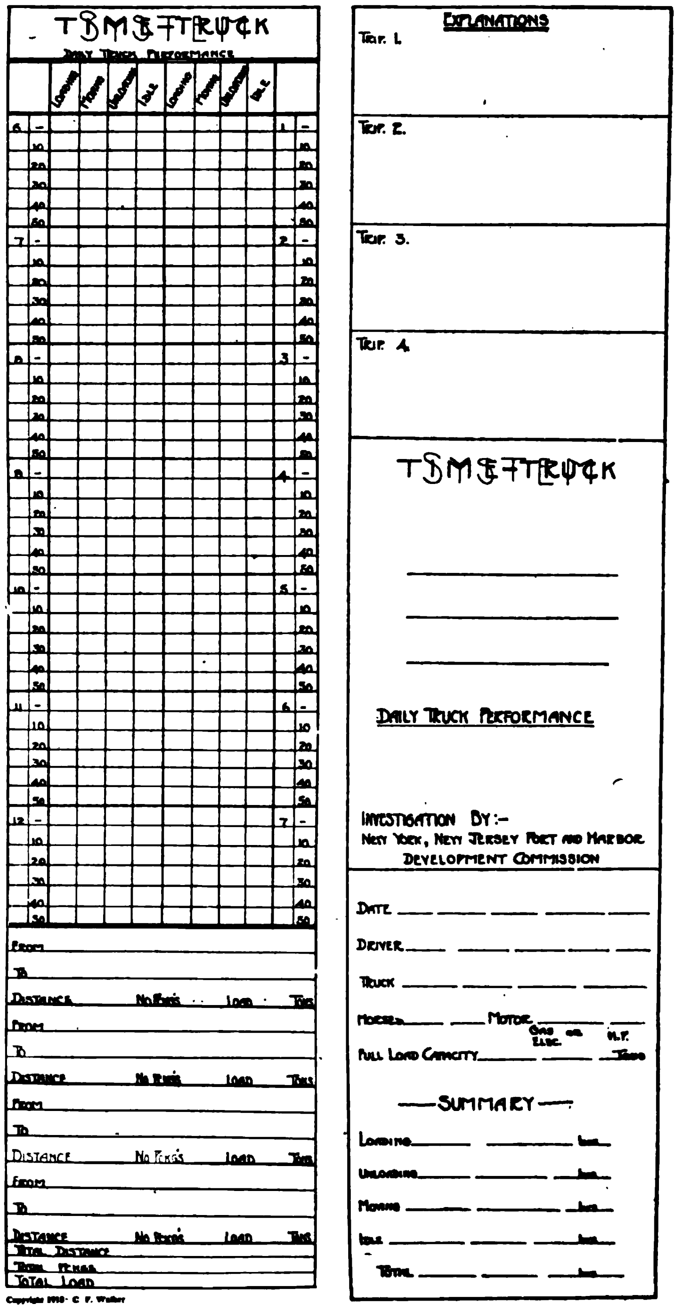
All of these improvements would unquestionably tend to lessen the losses included under the last heading, slow speed. Under present conditions there are far too many trucks engaged in moving the tonnage that is moved. By their very numbers they delay each other, the congestion being so great on the most heavily-traveled routes that even under favorable weather conditions the trucks are held up at nearly every corner, while during unfavorable weather the congestion is greatly increased and some of the streets become virtually impassable. If through the elimination of unnecessary delays, light loads and excessive distances the total number of trucks engaged in moving the business could be greatly reduced, the clearing of the streets would inevitably result in a greater average speed obtainable for those trucks remaining in operation.

TIME TRUCK STUDIES

In order to understand more fully the conditions under which trucks operate in Manhattan and vicinity, the Commission's forces made what are designated as time truck studies, in which members of the field force rode with representative trucks for periods ranging from two to six days. Operations of horse trucks were followed in this manner for sixty-three days, and of motor trucks for thirty-three days.

The form which is reproduced as Fig. 2 was prepared to be filled out by the men who rode on the trucks. On this card a continuous graph of the trucks from stable or garage back to stable or garage or from store door back to store door could be recorded. The graph was made with either pencil or punch.

The charts, Figs. 3 and 4, have been made up from these cards. Fig. 3 shows the time performances of



TIME TRUCK

DAILY TRUCK PERFORMANCE

		LOADING	MOVING	UNLOADING	IDLE	LOADING	MOVING	UNLOADING	IDLE		
6	-									1	-
	10										10
	20										20
	30										30
	40										40
	50										50
7	-									2	-
	10										10
	20										20
	30										30
	40										40
	50										50
8	-									3	-
	10										10
	20										20
	30										30
	40										40
	50										50
9	-									4	-
	10										10
	20										20
	30										30
	40										40
	50										50
10	-									5	-
	10										10
	20										20
	30										30
	40										40
	50										50
11	-									6	-
	10										10
	20										20
	30										30
	40										40
	50										50
12	-									7	-
	10										10
	20										20
	30										30
	40										40
	50										50

FROM

TO

DISTANCE ______ NO. FERRIES ______ LOAD ______ TONS

FROM

TO

DISTANCE ______ NO. FERRIES ______ LOAD ______ TONS

FROM

TO

DISTANCE ______ NO. FERRIES ______ LOAD ______ TONS

FROM

TO

DISTANCE ______ NO. FERRIES ______ LOAD ______ TONS

TOTAL DISTANCE

TOTAL FERRIES

TOTAL LOAD

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EXPLANATIONS

TRIP 1.

TRIP 2.

TRIP 3.

TRIP 4.

TIME TRUCK

DAILY TRUCK PERFORMANCE

INVESTIGATION BY:—
NEW YORK, NEW JERSEY PORT AND HARBOR
DEVELOPMENT COMMISSION

DATE ______

DRIVER ______

TRUCK ______

HORSES ______ MOTOR ______ GAS OR ELEC. ______ H.P.

FULL LOAD CAPACITY ______ TONS

—SUMMARY—

LOADING ______ HRS.

UNLOADING ______ HRS.

MOVING ______ HRS.

IDLE ______ HRS.

TOTAL ______ HRS.

FIG. 2 — Form Used for Time Truck Studies

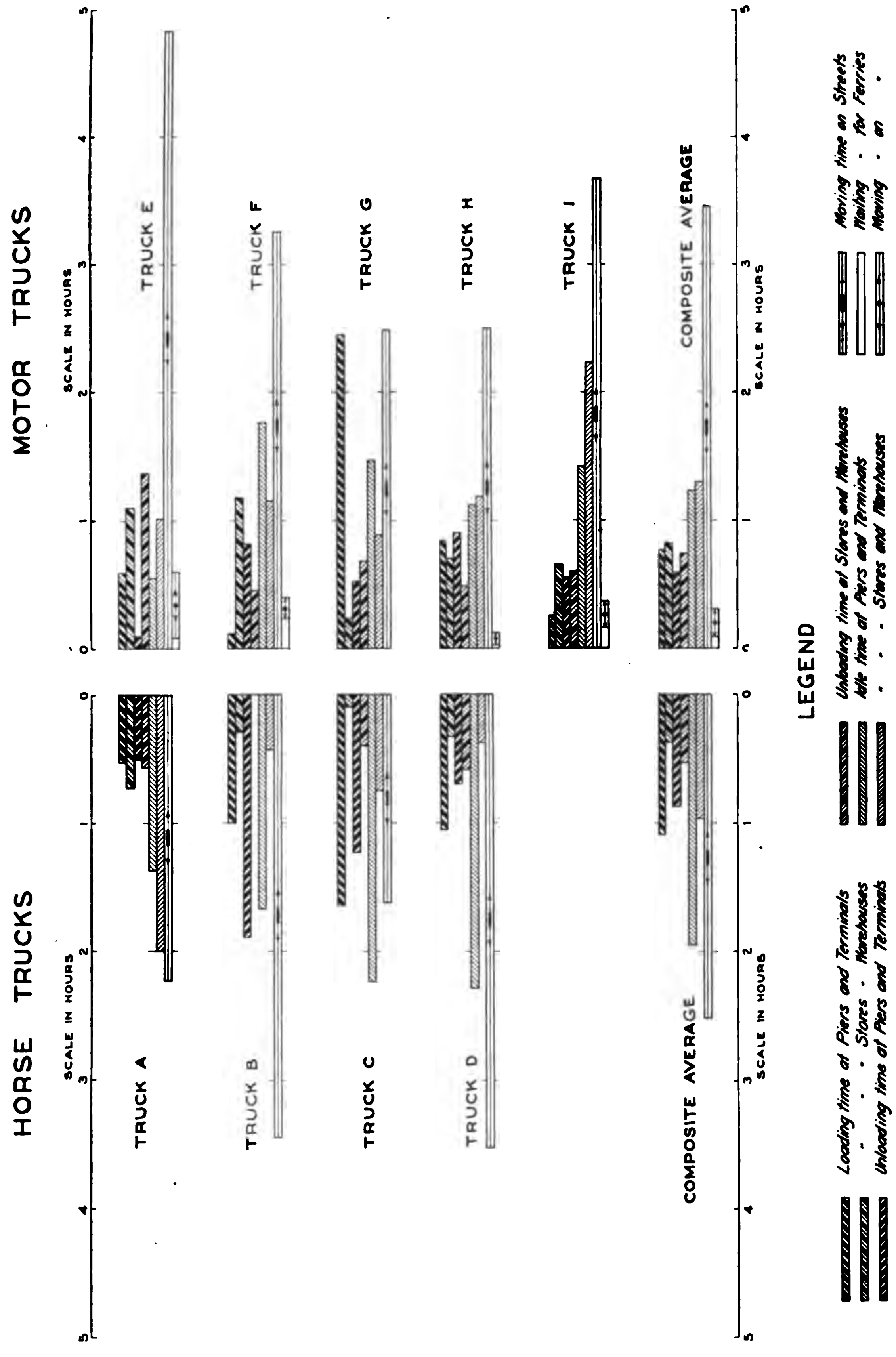


FIG. 3 — Time Performances of Four Two-Horse and Five Motor Trucks, All of Five Tons Capacity, and Composite Averages of the Trucks of Each Group

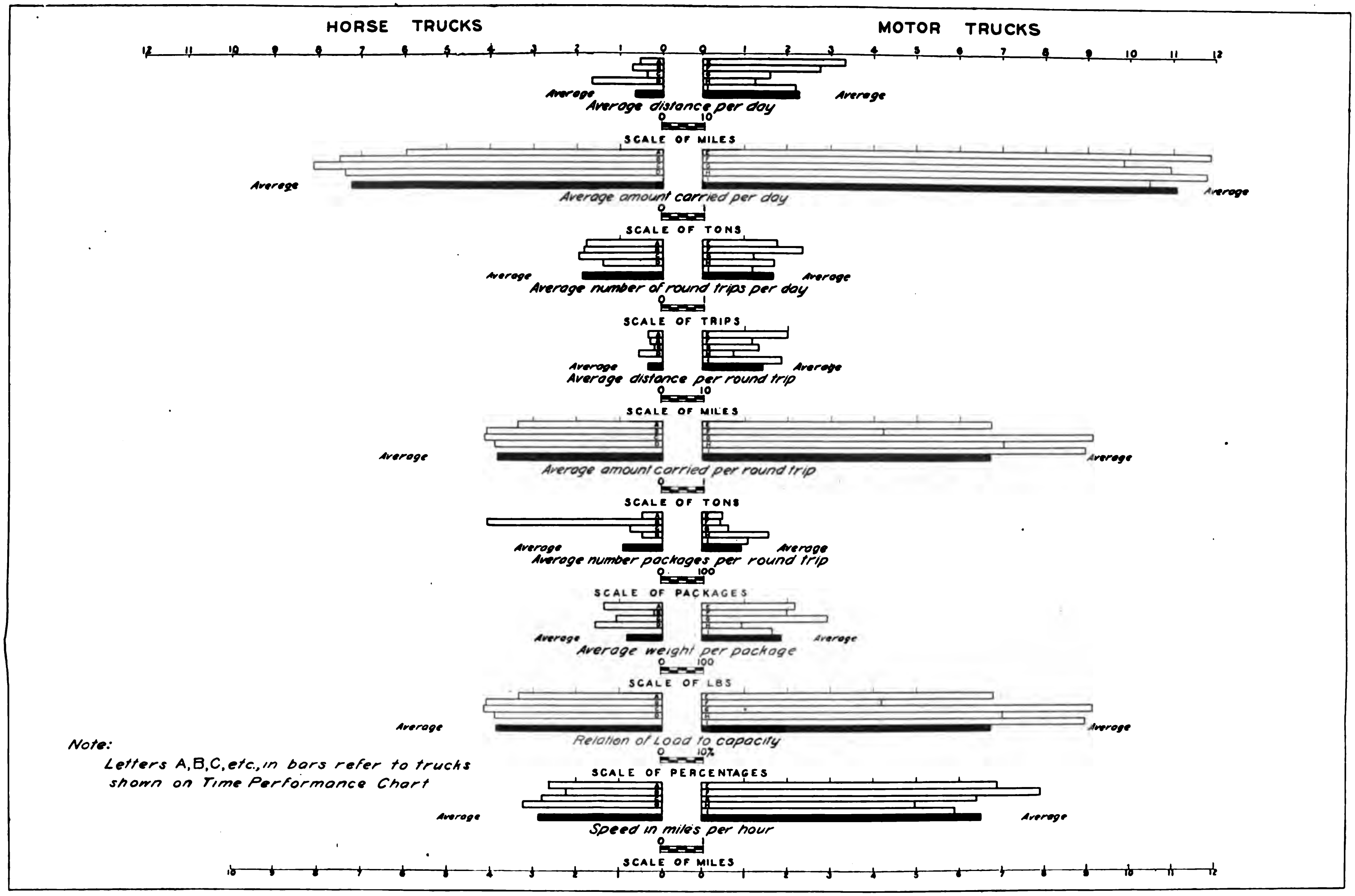


FIG. 4 — Load, Distance and Speed Performances of Same Nine Trucks as in Fig. 3, Together with Composite Averages for Each Group

four two-horse trucks and five motor trucks, all of 5-ton capacity. Fig. 4 shows the load, distance and speed performances of the same trucks. It should be noted that the idle time in Fig. 3 represents delays in the day's work, not days during the year when the trucks were not working.

The character of each truck and the service in which it was employed, and the duration of the study, are indicated as follows:

Truck A—Eighteen-day study of 5-ton two-horse trucks in contract service for merchants in Manhattan.

Truck B—Six-day study of a 5-ton two-horse truck, merchant-owned, in Manhattan service.

Truck C—Twenty-one-day study of 5-ton two-horse trucks in railroad transfer service in Manhattan.

Truck D—Eighteen-day study of 5-ton two-horse trucks in general truckmen's service, Manhattan.

Truck E—Eight-day study of 5-ton gasoline trucks in express service between Manhattan and Newark.

Truck F—Six-day study of a 5-ton gasoline truck, merchant-owned, between Manhattan, Brooklyn and Bayonne.

Truck G—Five-day study of a 5-ton gasoline truck in railroad transfer service, Manhattan.

Truck H—Eight-day study of 5-ton gasoline trucks in general truckmen's service, Manhattan.

Truck I—Six-day study of a 5-ton electric truck in a Brooklyn truckman's service between Manhattan and Brooklyn.

The horse trucks chosen were in Manhattan service and reflect more nearly conditions at freight terminals and stores than do the motor trucks, of which four were in service between Manhattan and the suburbs and only three in a service comparable with that of the horse trucks. The motor trucks were studied for the sake of the light they would shed on the plan (Chapter 12) calling for the substitution of motor trucks for cars, car floats and lighters in the delivery and collection of Manhattan freight.

The comparison developed by the two charts shows clearly the service to which each class of vehicle is better adapted. While changes in the design of freight terminals will undoubtedly increase the use of motor trucks, it is questionable whether they will ever supplant the horse for short-distance service. At the present time horse trucks probably do 70 per cent of the trucking at freight terminals. Because of this fact, and because the charts show a load efficiency of only 38.53 per cent for horse trucks as compared with 67.27 per cent for motor trucks, leaving the horse trucks with more opportunity for improvement, the trucking economies that are possible with better terminal design, better reorganization and a zoning system are figured in terms of the costs of two-horse trucks.

Delays at Piers

During the railroad clockings information was obtained as to the number of trucks that brought freight to and took it from all railroad pier stations, the tonnage they brought to or took from the stations and the time they were there. From these clockings Tables 4–7 and Figs. 5–12 have been prepared to cover the inbound

Table 4 — Loading, Time Consumed and Cost of Idle Time of Trucks Receiving Inbound Freight at Thirty-One Hudson River Pier Stations During 1918 Clockings

	Number of trucks observed (*a*)	Amount of freight removed, tons (*b*)	Total time on piers, hr.—min. (*c*)	Essential time for papers, r.—min. (*d*)	Essential time for travel on piers, hr.—min. (*e*)	Essential time for loading, hr.—min. (*f*)	Idle time at stations, hr.—min., $g=c-(d+e+f)$	Loss at $1.80 per truck-hour (*h*)
Full Working Day — Eleven Hours								
Total for day	4,232	8,661.81	3,033–40	426–44	352–48	1,588–12	665–56	$1,198.679
Average per truck		2.047	0–43.01	0–06.050	0–05.002	0–22.517	0–09.441	0.2832
Average per ton			0–21.01	0–02.955	0–02.444	0–11.000	0–04.611	0.1383
Maximum Hour as to Trucks, 10–11 A. M.—12.45% of Day's Total								
Total for hour	527	1,075.87	376–06	53–08	43–56	197–12	81–50	147.294
Average per truck		2.041	0–4282	0–006.050	0–05.002	0–22.451	0–09.317	0.2795
Maximum Hour as to Tonnage, 8–9 A. M.—12.85% of Day's Total								
Total for hour	460	1,112.67	348–26	46–23	38–21	204–00	59–42	107.460
Average per truck		2.419						
Average per ton			0–18.79	0–02.501	0–02.068	0–11.000	0–03.221	0.0966

Table 5 — Loading, Time Consumed and Cost of Idle Time of Trucks Receiving Inbound Freight at Eighteen East River Pier Stations During 1918 Clockings

	Number of trucks observed (*a*)	Amount of freight removed, tons (*b*)	Total time on piers, hr.—m'n. (*c*)	Essential time for papers, hr.—min. (*d*)	Essential time for travel on piers, hr.—min. (*e*)	Essential time for loading, hr.—min. (*f*)	Idle time at stations, hr.—min., $g=c-(d+e+f)$	Loss at $1.80 per truck-hour (*h*)
Full Working Day — Eleven Hours								
Total for day	1,253	3,374.13	776–09	126–21	55–28	449–55	144–25	$259.948
Average per truck		2.693	0–37.16	0–06.050	0–02.656	0–21.544	0–06.910	0.2075
Average per ton			0–13.80	0–02.247	0–00.986	0–08.000	0–02.567	0.0770
Maximum Hour as to Trucks, 10–11 A. M.—12.45% of Day's Total								
Total for hour	156	419.31	96–43	15–45	4–18	55–55	20–45	37.350
Average per truck		2.688	0–37.19	0–06.050	0–01.654	0–21.504	0–07.982	0.2394
Maximum Hour as to Tonnage, 3–4 P. M.—13.10% of Day's Total								
Total for hour	153	441.90	79–58	15–26	4–13	58–55	1–24	2.520
Average per truck		2.888						
Average per ton			0–10.86	0–02.096	0–00.572	0–08.000	0–00.192	0.0058

and outbound movements at thirty-one Hudson River stations and eighteen East River stations. Allowance is made for the necessary time to obtain papers, to do the work of loading and unloading, and to run the necessary distance on the pier for inbound freight, and the cost of the remaining idle time is computed in terms of the value per hour of a two-horse truck, estimated to be $1.80 in 1919.

It is apparent from these tables that the losses in time are considerably less than is commonly claimed by merchants and truckmen. The clockings were made while the Railroad Administration was in charge of the railroads, with its opportunity for distributing the loads over different stations, and it is probable that the delays averaged higher prior to the war. Even as shown by the tables they are by no means negligible. Applied to the estimated 1929 tonnage of 10,000,000 — 6,000,000 tons inbound and 4,000,000 tons outbound — the losses from unnecessary delays would amount to $1,644,000 annually.

On inbound business the delays to trucks at steamship terminals are about the same as at railroad piers, but on outbound business they are much greater. The interviews and questionnaires conducted by the Commission indicate that delays of from two to twenty-four hours occur.

There is a certain weakness in all piers in that whether or not street trucks run upon the piers they enter and leave the terminal at the same end of the pier, which naturally tends to street congestion. In lower Manhattan the difficulty is greatly intensified by the fact that the piers are narrow, with team access at only one level. Ordinarily inbound freight is delivered on the piers, and outbound is received at the bulkhead sheds. The provisions are entirely inadequate for either. Trucks calling for freight must pass through a narrow gateway to the pier, and wend their way slowly among standing and moving trucks and piles of freight until they get back upon the street. Trucks bringing freight must await their turn at bulkhead platforms far too short to receive the trucks as fast as they come. Lines of both classes of trucks form and are overlapped by similar lines for adjacent piers, or for ferries, and much confusion results, as some of the accompanying photographs show.

Because steamships do not clear every day as cars at railroad pier stations do, the confusion is even greater at steamship piers than at railroad piers. The Marginal Way becomes more congested; the steamship companies, lacking space within their pier structures, often use the Marginal Way for open storage of non-perishable goods, and even as a trucking floor for conducting their daily business.

The congestion can be almost eliminated by improved pier design — wider, double-decked piers, with team access at both levels. This will involve a reduction in the number of piers, since the slips are also too narrow for economical lighterage operations, and the consequent removal of some of the companies using the piers. Inasmuch as the railroads do not require piers they are the logical ones to withdraw, and the automatic-electric

TABLE 6 — LOADING, TIME CONSUMED AND COST OF IDLE TIME OF TRUCKS DELIVERING OUTBOUND FREIGHT AT THIRTY-ONE HUDSON RIVER PIER STATIONS DURING 1918 CLOCKINGS

	Number of trucks observed (a)	Amount of freight delivered, tons (b)	Total time at station, hr.—min. (c)	Essential time for unloading, hr.—min. (d)	Waiting time on street and at platform, hr.—min. (e = c — d)	Essential time for papers, hr.—min. (f)	Idle time at stations, hr.—min. (g = e — f)	Loss at $1.80 per truck-hour (h)
Full Working Day — Eleven Hours								
Total for day	3,270	2,987.27	1,092—06	558—05	534—01	54—30	479—31	$863.13
Average per truck	....	0.9135	0—20.04	0—10.24	0—09.80	0—01.00	0—08.80	0.2640
Average per ton	....	....	9—21.94	0—11.21	0—10.73	0—01.095	0—09.631	0.2889
Maximum Hour as to Trucks, 2–3 P. M.— 14.37% of Day's Total								
Total for hour	470	378.51	140—50	79—26	61—24	7—50	53—34	96.42
Average per truck	....	0.80	0—17.98	0—10.14	0—07.84	0—01.00	0—06.839	0.2052
Maximum Hour as to Tonnage, 10–11 A. M.— 13.77% of Day's Total								
Total for hour	453	411.40	139—59	69—48	70—11	7—33	62—38	112.74
Average per truck	....	0.908	....	....	....	....	....	....
Average per ton	....	....	0—20.41	0—10.18	0—10.23	0—01.090	0—09.140	0.2740

TABLE 7 — LOADING, TIME CONSUMED AND COST OF IDLE TIME OF TRUCKS DELIVERING OUTBOUND FREIGHT AT EIGHTEEN EAST RIVER PIER STATIONS DURING 191 CLOCKINGS

	Number of trucks observed (a)	Amount of freight delivered, tons (b)	Total time at station, hr.—min. (c)	Essential time for unloading, hr.—min. (d)	Waiting time on street and at platform, hr.—min. (e = c — d)	Essential time for papers, hr.—min. (f)	Idle time at stations, hr.—min. (g = e — f)	Loss at $1.80 per truck-hour (h)
Full Working Day — Eleven Hours								
Total for day	1,308	1,997.08	439—47	263—13	176—34	21—48	154—46	$278.58
Average per truck	....	1.527	0—20.17	0—12.07	0—08.10	0—01	0—07.100	0.2130
Average per ton	....	....	0—13.21	0—07.91	0—05.30	0—00.655	0—04.643	0.1394
Maximum Hour as to Trucks, 10–11 A. M.— 14.53% of Day's Total								
Total for hour	190	256.86	58—30	31—10	27—20	3—10	24—10	43.500
Average per truck	....	1.352	0—18.47	0—09.84	0—08.63	0—01	0—07.632	0.2290
Maximum Hour as to Tonnage, 2–3 P. M.— 13.01% of Day's Total								
Total for hour	180	259.76	45—16	28—40	16—36	3—0	13—36	24.48
Average per truck	....	1.443	....	....	....	....	....	....
Average per ton	....	....	0—10.46	0—06.62	0—03.84	0—00.693	0—03.142	0.0942

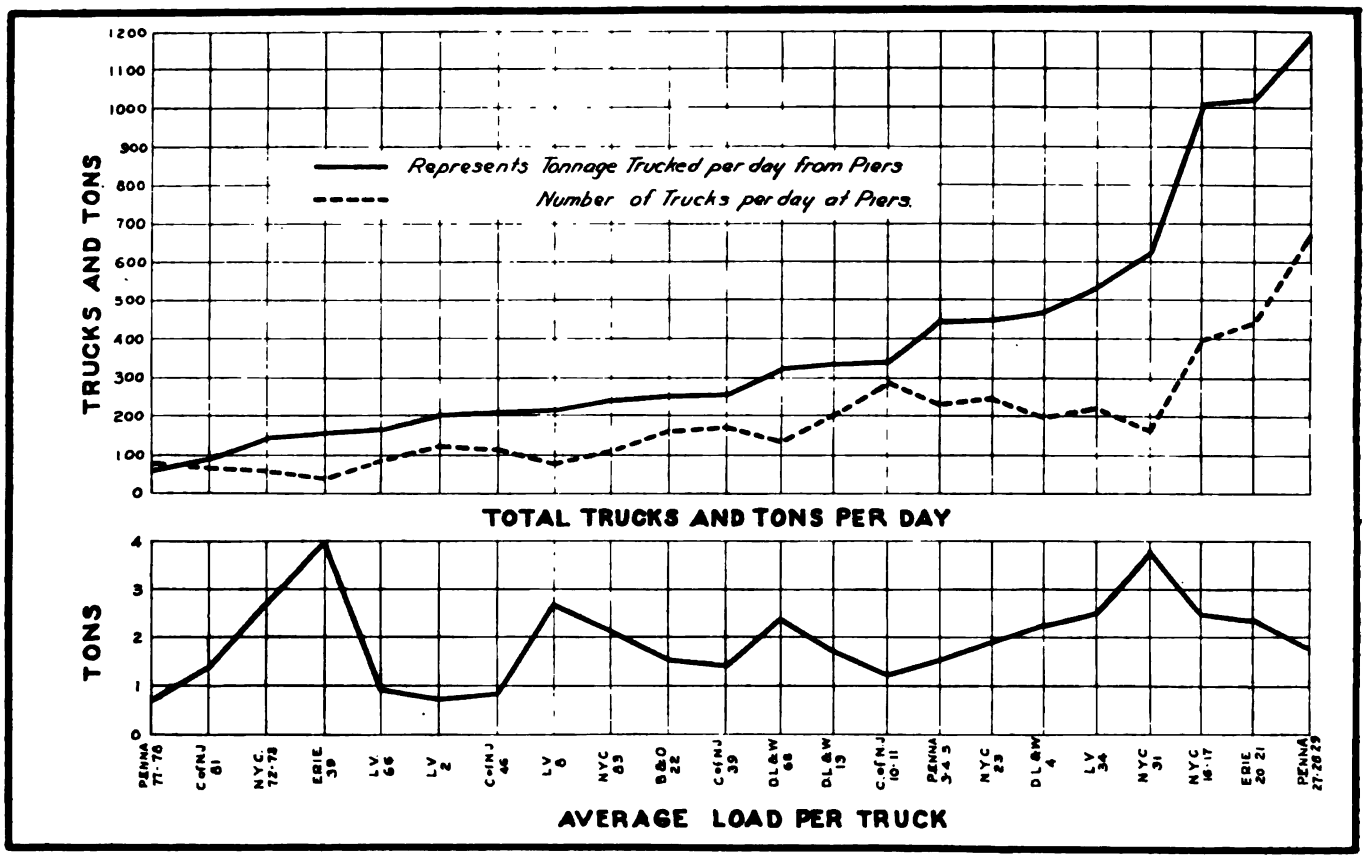


Fig. 5 — Number of Trucks and Tons of Freight Handled per Day, and Average Load per Truck, Inbound at Hudson River Pier Stations

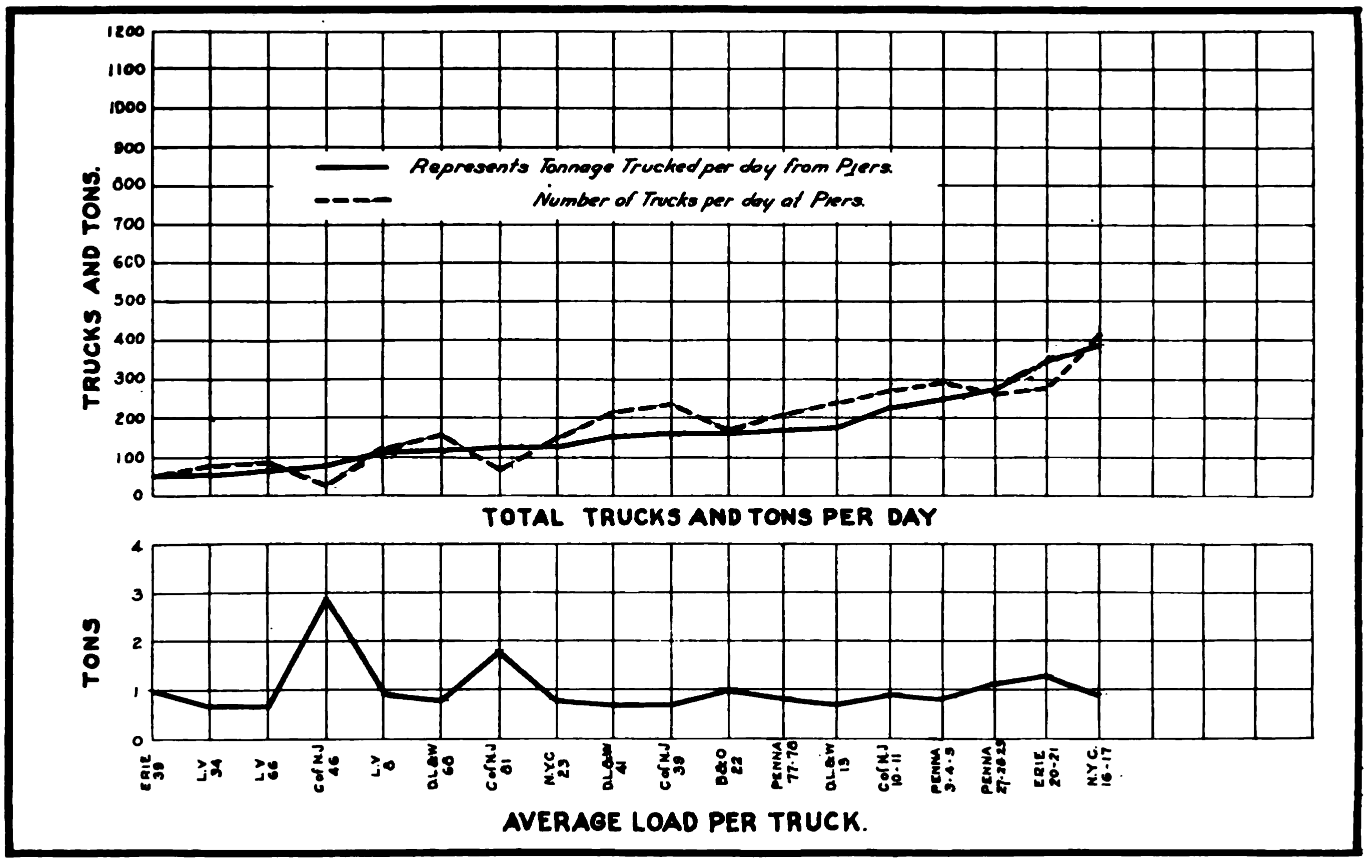


Fig. 6 — Number of Trucks and Tons of Freight Handled per Day, and Average Load per Truck, Outbound at Hudson River Pier Stations

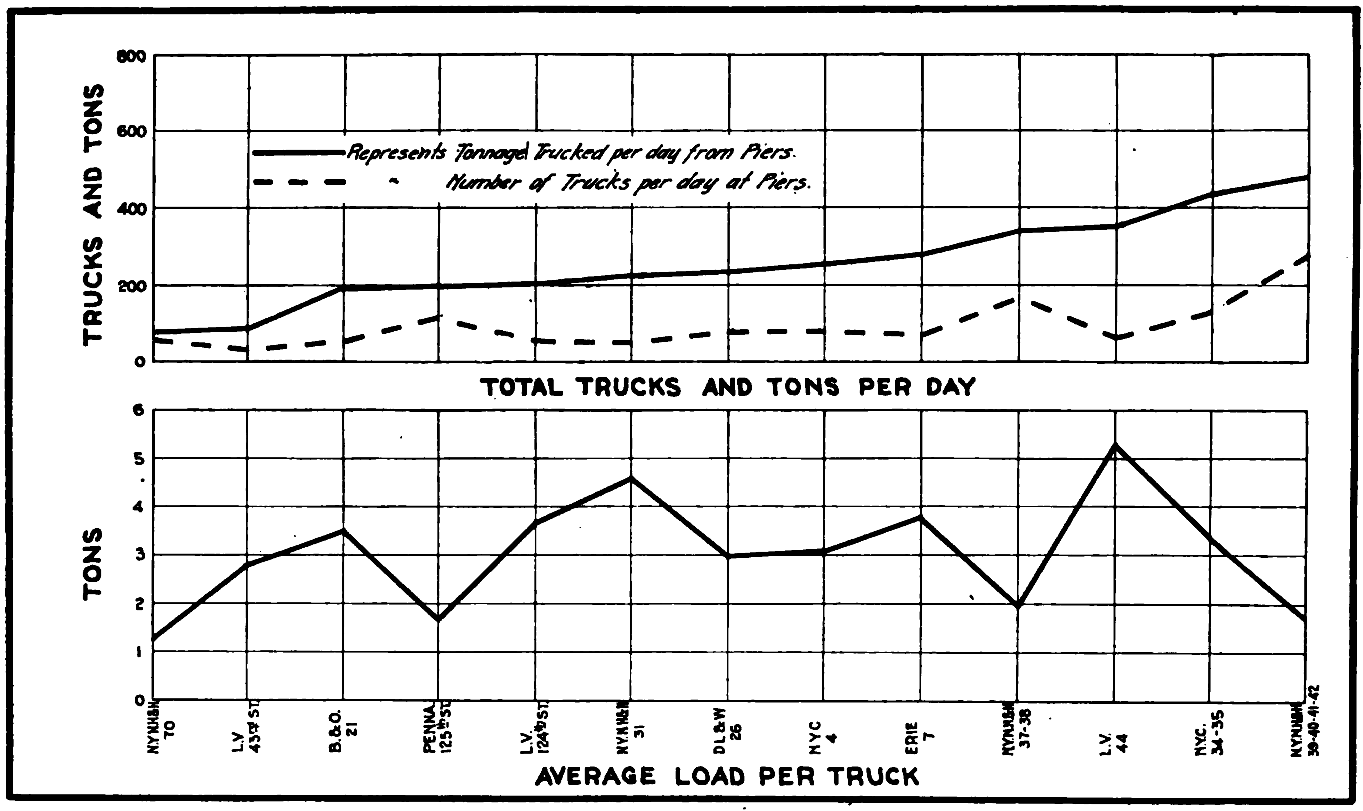


FIG. 7 — Number of Trucks and Tons of Freight Handled per Day, and Average Load per Truck, Inbound at East River Pier Stations

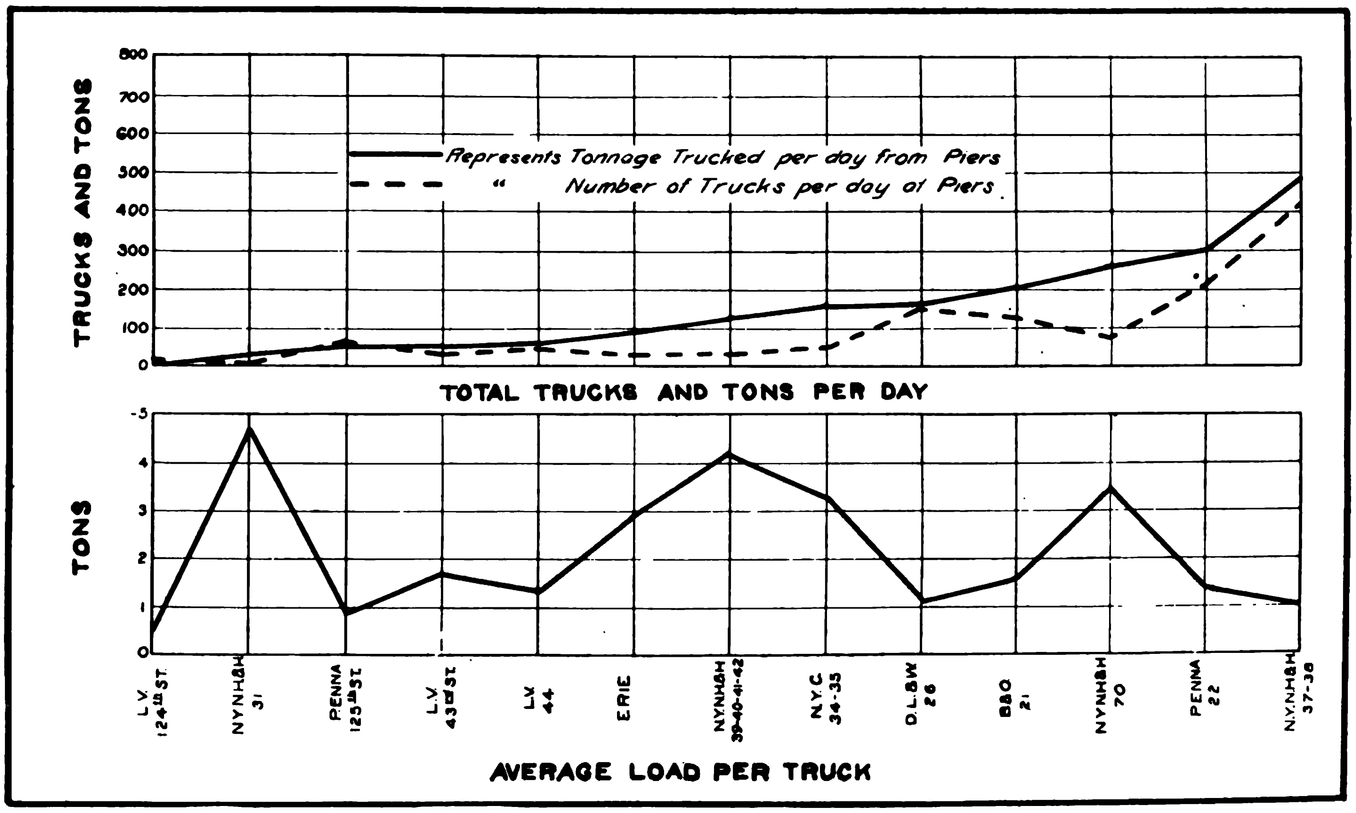


FIG. 8 — Number of Trucks and Tons of Freight Handled per Day, and Average Load per Truck, Outbound at East River Pier Stations

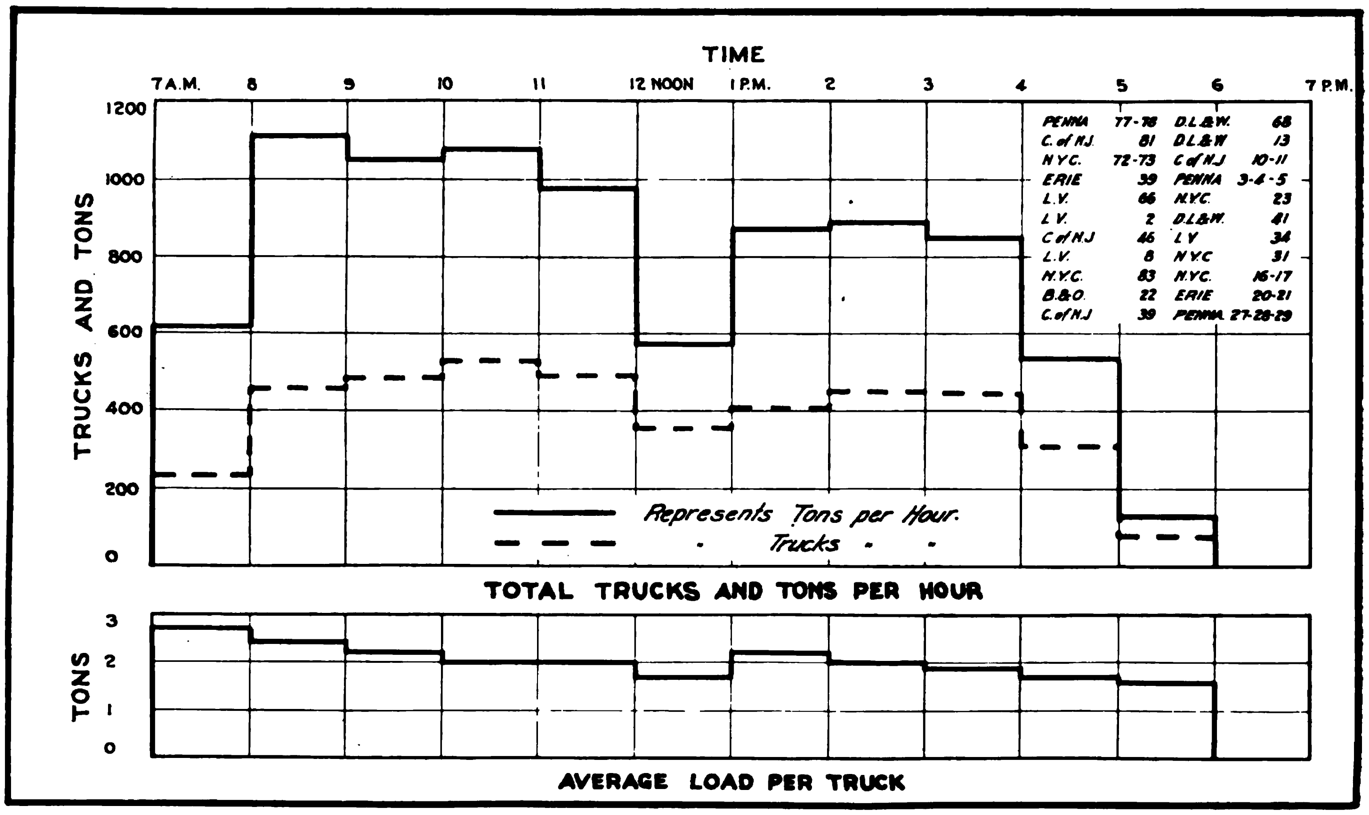


Fig. 9 — Composite of Hourly Truck Performances — Trucks and Tons per Hour and Tons per Truck — Inbound at Hudson River Pier Stations

Table in upper right-hand corner indicates companies operating and numbers of piers included in the clockings.

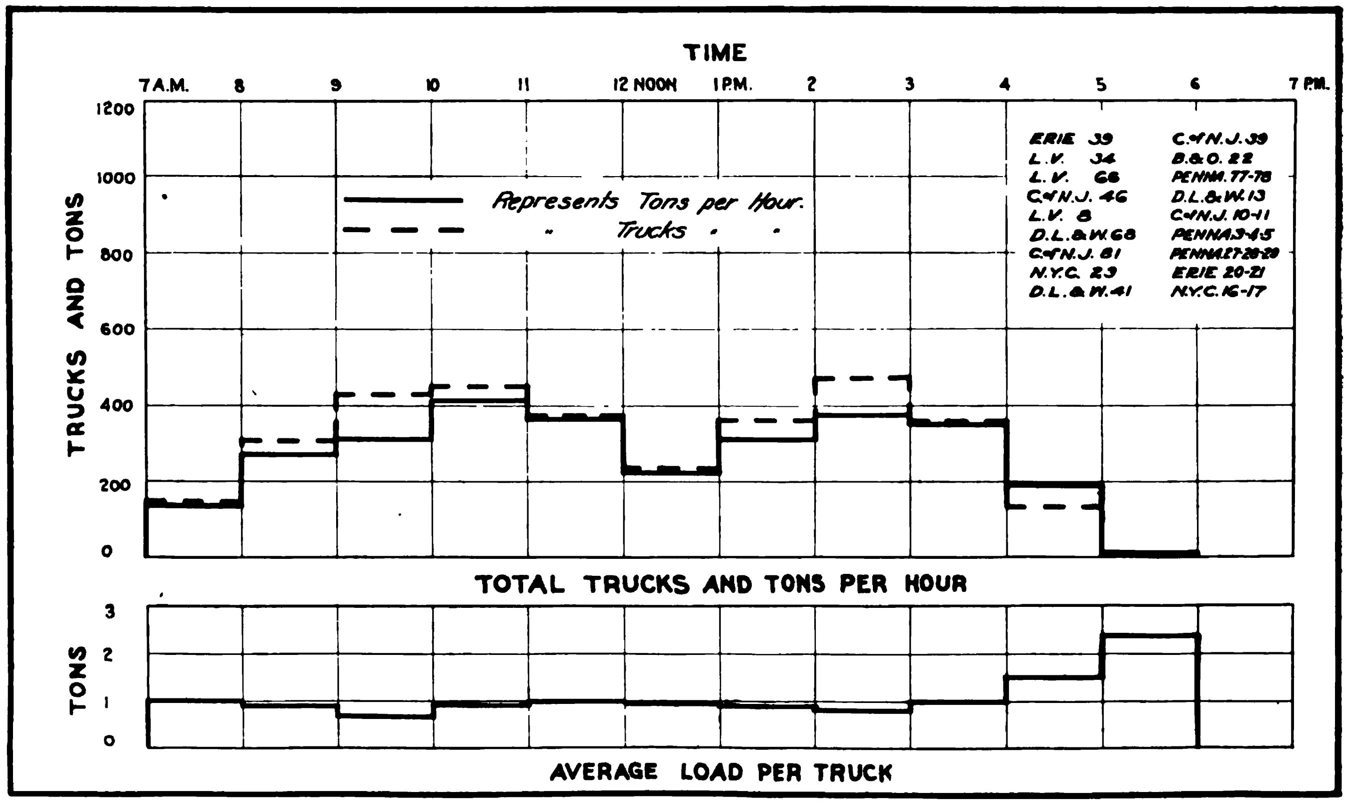


Fig. 10 — Composite of Hourly Truck Performances — Trucks and Tons per Hour and Tons per Truck — Outbound at Hudson River Pier Stations

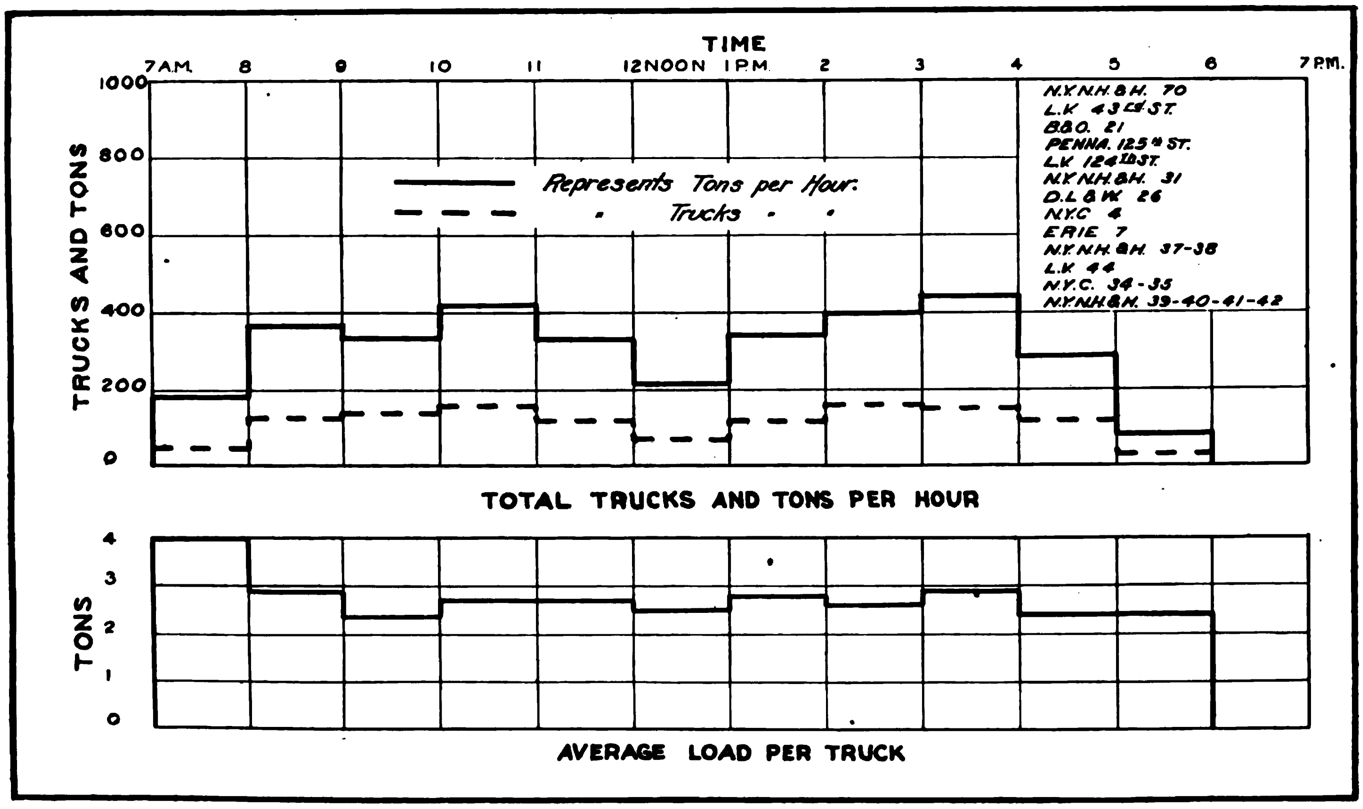


FIG. 11 — Composite of Hourly Truck Performances — Trucks and Tons per Hour and Tons per Truck — Inbound at East River Pier Stations

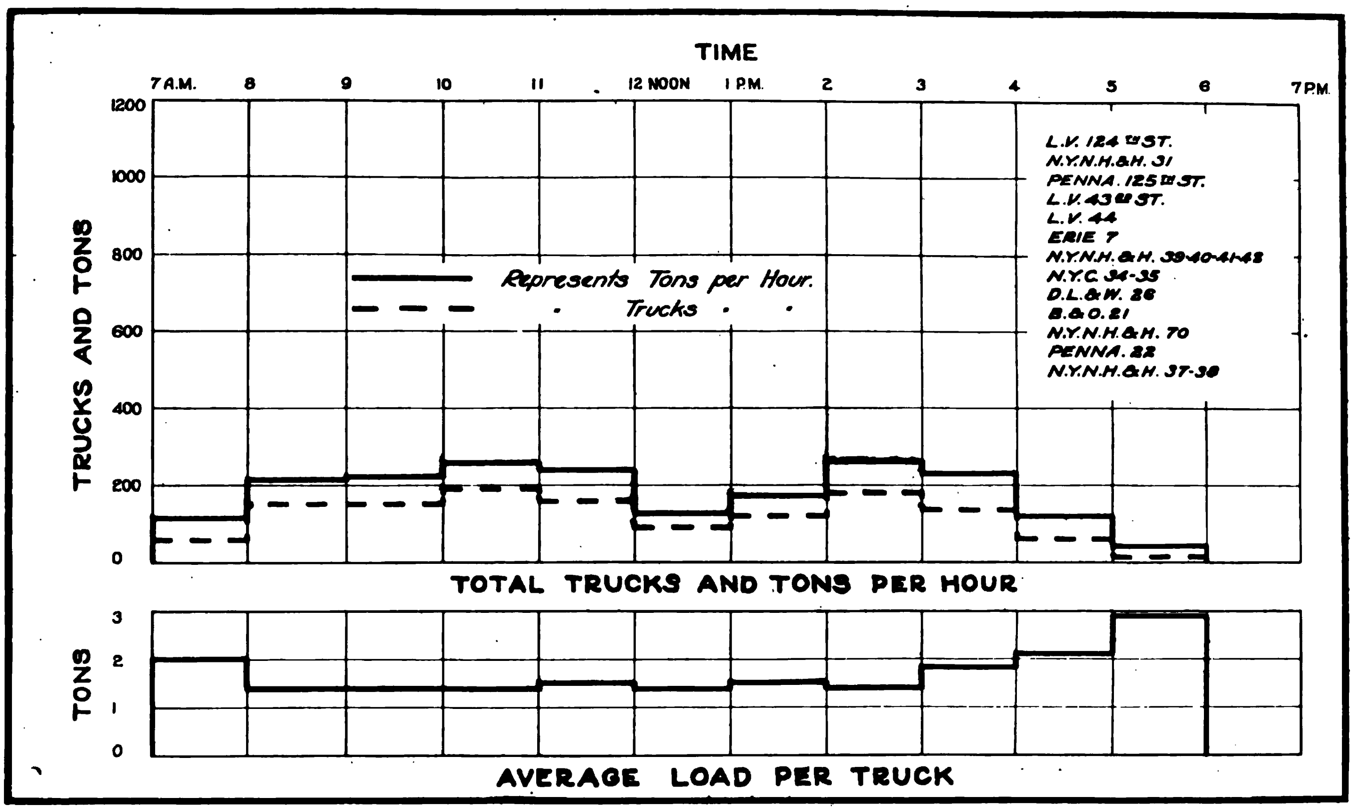


FIG. 12 — Composite of Hourly Truck Performances — Trucks and Tons per Hour and Tons per Truck — Outbound at East River Pier Stations

plan provides them with inland terminals with separate truck entrances and ample tailboard space, eliminating the excessive trucking delays, leaving the way open for a reorganization of the Manhattan waterfront in accordance with the plan described in Chapter 21 of this report.

DELAYS AT WAREHOUSES

The Commission's interviews and questionnaires indicate that the delays at warehouses are as bad as or worse than the delays at the freight terminals of the carriers. It is asserted that trucks remain in line all day at many of the warehouses and that waits of from four to ten hours occur. Adequate and well designed loading platforms are conspicuous by their absence. Poor elevator service is characteristic. At the majority of the warehouses hundreds of tons of freight are daily lifted and lowered an unnecessary three feet for want of proper platforms.

The lack of co-ordination of effort between truckmen and warehousemen is very apparent. It is asserted that at tobacco warehouses waits for Government inspectors are frequent. On the other hand, the warehouseman often has no information that goods are to be removed until the truck arrives to remove them. Naturally that truck has to wait, to the detriment of the other trucks.

An inspection of the time truck charts shows that 33 per cent of the idle time for horse-drawn trucks and 51 per cent of the idle time for motor-driven trucks occurred at stores, factories and warehouses. Here the remedy lies elsewhere than with the carriers.

DELAYS AT FERRIES

Trucks have long waits at the ferries, and the long lines have in recent years contributed more than any other single factor to the congestion in West Street. The boats are operated primarily in accordance with the passenger travel (see Chapter 19), and during peaks of truck traffic, where there are fewer boats running than during the morning and evening rush hours, long waits are unavoidable. The schedules could be adjusted better to the traffic, while truckmen could advantageously in many instances choose better times to cross the rivers or bay.

The time truck studies show that the average wait in line for ferryboats on thirty-eight trips was only five minutes per trip. These trucks, however, were despatched with some regard for ferry schedules.

Ferry bridges are almost without exception too short. The average load on a New York truck cannot be taken up to the boat during high tides or brought up from the boat during low tides without assistance of some sort, and much complaint is made on this account. Ferry bridges should be made longer, so that during the extremes of tide trucks could enter and leave the boats without outside assistance.

PART LOADS

Possibly the greatest single source of loss in trucking is the carrying of part loads. The data obtained from the time truck studies show that the horse trucks carried on the average only 38.53 per cent of their capacity. On the basis of an average working day of 8 hr., 17 min., as indicated for horse-drawn trucks in the time truck studies (see Fig. 3), at $1.80 per hour, the daily cost of a horse-drawn truck may be assumed to be $14.91. The average tonnage shown to have been handled in a day (Fig. 4) was 7.22 tons. This makes the cost per ton $2.07. If full loads could have been obtained the cost per ton would have been only 80 cents, which indicates a waste of $1.27 per ton.

The motor trucks covered by the time truck studies showed a load-carrying efficiency of 67.27 per cent. They covered an average of 22.39 miles and carried an average tonnage of 11.10 tons (Fig. 4). On the basis of the costs in Table 1 the cost per day of a truck would be $18.29 plus $0.2167 per mile, to which sum 15 per cent profit should be added (included in the $1.80 per hour for horse trucks), giving a total of $26.61 per day. The cost per ton thus comes to $2.40. If full loads could have been obtained the cost per ton would have been only $1.61. The waste is therefore about 79 cents per ton. The figures in all cases disregard idle time.

There are many causes for these light loads. When the shipper or consignee has not in a day enough freight to be moved to or from one locality, or has not goods to be moved in both directions, the only remedy for the part load or the empty truck in one direction is a consolidation of the service to him with that to other small shippers, to which the present haphazard organization of trucking does not lend itself.

A contributing cause to the part load that will be largely eliminated by the installation of the system recommended by the Commission is the large number of pier stations which the system will replace. A truck may start out with small consignments for several railroads and make deliveries to as many as eight stations, or it may call on as many to receive inbound freight. A study was made by the Commission's field forces of 1,365 pick-up trucks making from one to eight deliveries per truck, which showed an average load of 2.25 tons per truck at the high point of the trip, while a similar study of 1,239 trucks removing inbound freight from piers and collecting from as many as eight piers showed an average of 2.785 tons per truck at the high point.

LOSSES THROUGH EXCESSIVE HAUL

Waterfront under the present competitive system is at such a premium that not every carrier is able to provide terminals at the points most advantageous to the shipper or consignee, or to handle his business at the station nearest to him. The result is much unnecessary mileage.

To illustrate the economy possible through the consolidation of railroad terminals and the zoning system contemplated in the automatic-electric plan, a random selection was made of Piers 16, 17, 23 and 31 on the Hudson River, and the St. Johns Park Station, all of which are New York Central freight stations on the West Side. The railroad clockings for these stations indicated that 3,004.34 tons of freight were trucked a total of 1,080.61 miles from the stations to the consignees, and that 706.16 tons were trucked a distance of 861 miles to the stations from the shippers. Comparative distances were then scaled on the map from selected sites for inland stations to the same consignees and from the same shippers. The corresponding distances were 787.33 truck-miles for the inbound freight and 640.62 truck-miles for the outbound, making savings of 293.28 miles and 220.38 miles respectively.

At an average rate of travel of 2.86 miles per hour (indicated by the clockings) and a cost of trucking of $1.80 per hour, this would mean a saving of $0.0614 per ton on inbound freight and $0.1964 per ton on outbound freight. These unit savings applied to 6,000,000 tons inbound and 4,000,000 tons outbound, the expected tonnage in 1929, would give a saving of $1,154,000 in reduced haul, principally north-and-south haul.

A record of one day's trucking for all of the New York Central's West Side freight stations except those north of Fifty-ninth Street is shown in Fig. 10, Part IV. The ends of the lines radiating from the various stations indicate the point of origin or destination of the truck load. In the case of goods trucked to or from points outside of Manhattan the lines terminate at the bridge or ferry used by the truck, while the lines terminate at Fifty-ninth Street for all goods trucked to or from north of that street.

Further material reductions in trucking distances are expected through the reassignment of steamship piers, the building of more supporting warehouses near the piers, the establishing of direct rail service to more piers outside of Manhattan, the reorganization of the system of food distribution, and the providing of factory space in the automatic-electric terminal buildings themselves.

Tailboard Cases and Store-Door Delivery

In 1914 team owners' associations in New York City as well as in Philadelphia and Cincinnati petitioned the Interstate Commerce Commission to compel the rail and water carriers to deliver their freight to the tailboard of the truck; that is, either to permit the consignees to back their trucks to the point in the station where the goods had been placed, or, if that was impracticable, to have the carriers' own employees truck the goods to the tailboards of the wagons. In the case of outbound goods the petition sought to compel the carriers to receive the goods at the tailboard without requiring the complainants to make deliveries at more than one point or remove goods previously unloaded at the one point. The complainants charged the carriers with failure to perform their full duty as common carriers, and with discriminatory practices.

The Interstate Commerce Commission denied that the carriers were failing to perform their full duty, and declined to order them to modify their practices. The opinion is quoted at some length as setting forth conditions which prevailed in 1914, and still prevail in a large measure.

Drays on South Street, East River, Manhattan, in the Vicinity of a Steamship Pier

> "These three proceedings represent a concentrated effort on the part of certain associations of teamowners in Philadelphia, New York and Cincinnati to bring about a change in the rules and regulations adopted by the defendant carriers at those points with respect to the receipt and delivery of less-than-carload package freight. The complaining associations include within their membership numerous firms and individuals engaged in trucking merchandise for others to and from freight stations and piers. The National Team Owners' Association, with which the above named associations are allied, was granted leave, upon petition, to intervene as complainant. The defendants named in the complaints include not only railway lines, but water carriers plying to and from the ports of Philadelphia and New York and other

ports within the United States, and also water carriers engaged exclusively in the foreign trade.

"It is alleged that the defendant carriers do not perform their full duty as common carriers in that they do not make a proper and complete delivery of freight at their terminals, and that they discriminate between persons and places. Stated more in detail, the complaints allege —

"1. That the defendants do not separate, segregate or make conveniently accessible freight received for local delivery.

"2. That they do not maintain stations with sufficient floor space, so that congestion and delays result.

"3. That shipments are piled in masses, with the marks frequently covered or turned down, and without aisles of sufficient width to permit the passage of a hand truck.

"4. That reasonable facilities are not provided for the loading and unloading of less-than-carload freight.

"5. That the defendants segregate, or place in designated locations on the station platforms or floors, merchandise consigned to certain teamsters and consignees, while refusing to perform this service for others.

"6. That the complainants are discriminated against in that greater assistance in removing freight is rendered by employees of some of the defendants at other points.

"7. That the delays resulting from the alleged confusion at freight stations subject the complainants to undue and unreasonable expense and retard the movement of freight across the platform.

"The relief prayed for is an order directing the defendants to place in effect a rule providing for a so-called tailboard delivery and tailboard receipt of less-than-carload freight. By tailboard delivery is meant that the defendants shall make the goods readily accessible, either by permitting the complainants to back their trucks to the place at the station where the goods have been placed or, if the arrangement of the platform or pier renders that impracticable, that the defendants, by their own employees, shall truck the goods to the tailboard of the wagons. By tailboard receipt is meant that the defendants shall promptly receive outgoing merchandise at the tailboards of the wagons, without requiring the complainants to remove the goods previously unloaded at that point by other shippers, and at more than one location upon the station platform.

"It is unnecessary to discuss at length the different methods that have been adopted by the carriers for the delivery of less-than-carload freight. It may well be assumed that the methods and practices finally determined upon are those which, in the judgment of the operating officials of the carriers, are best adapted to meet the conditions at each station, and to permit of the handling of freight with rapidity and justifiable economy. While the details of those methods vary at the different stations the general practice appears to be about as follows:

"The inbound cars, upon arrival, are promptly unloaded, the freight for local delivery being arranged on the station floor either by carloads, commodities or consignees; i. e., (1) all the freight in a given car is placed in one section of the terminal, or (2) it is separated by commodities, all similar articles being assembled in one section, or (3) it is arranged as to consignees in alphabetical order. Whichever method is used the station records definitely show the location of every shipment upon the station floor, and when the consignee or drayman, in response to the notice of arrival, calls for his goods, he is advised into which section they have been unloaded. He then backs his wagon into the nearest available doorway to that section, or, if the freight has been unloaded onto a pier, he drives down the pier to the designated section, or as near thereto as possible.

"The feature of the delivery most objected to by the complainants is the difficulty promptly to locate the desired shipments. This condition is said to exist because the goods of one merchant are frequently superimposed upon those of another or so intermingled as to necessitate additional handling, with a resultant loss of time. The defendants assert, on the other hand, that their employees have explicit directions to assist in locating freight, if called upon to do so, and to remove any obstruction to the ready and clear access to the package wanted.

"The legal duties of common carriers in connection with the delivery of package freight have been clearly stated in numerous decisions of the courts. From these decisions it appears that when the goods have been so placed in the warehouse at the point of destination as to be reasonably accessible to the consignee, open to his inspection, and permitting of their safe and convenient removal by the consignee or his agent, common-carrier liability ceases and the responsibility thereafter is that of a warehouseman only. It is likewise made clear, however, that goods are not regarded as being ready for delivery if they are so placed as not to be obtainable by the person to whom delivery is to be made or if they are so mingled with or covered by other goods that the consignee cannot inspect or remove them without himself undertaking their selection and separation from the heap.

Dray Lines on South Street and Burling Slip in Front of Fruit Piers

"Insofar as the defendants have failed to fulfill their obligations in these respects, they have failed in their duties as common carriers. The testimony is by no means conclusive, however, that they have wilfully refused or neglected to effect the full delivery contemplated by the law. On the contrary, the evidence shows that they are ready at all times to render any assistance that may be necessary to locate, uncover and place in an accessible position any package that is called for, and will even assist in loading it if it is too bulky or heavy to be loaded by the consignee.

"The law requires no more than this, and to require of the carriers an additonal movement of the freight from the floor of the warehouse to the trucks of the consignee or drayman would be unwarranted and arbitrary.

"It is true that at Cleveland, Buffalo and a few other places a modified system of tailboard delivery is in effect, having grown up largely through competitive influence or peculiar local conditions. At Cleveland, for example, this method was instituted by a railroad company having very limited facilities at its station for accommodating trucks, and it was thereafter adopted by other carriers competing for traffic in that city. Tailboard delivery was said to have been resorted to at Buffalo and other cities in an effort to lessen the amount of pilferage by teamsters. But even where this system is provided the teamsters are not excluded from the platforms, nor do the majority of them take advantage of it. The record shows that ordinarily the teamsters are not inclined to remain inactive on their wagons awaiting their turn for assistance by the carrier's employees, but, in order to avoid delay, prefer to secure their merchandise themselves, in the same manner as do the teamsters at Philadelphia, New York and Cincinnati. It is acknowledged of record that the teamsters of one city are not in competition with those of another, and it does not follow that because of a form of tailboard delivery maintained

> at a few places under peculiar and special conditions an order would be justified in imposing this duty upon the carriers at all places. No complaint has been filed by the actual consignees at Philadelphia or elsewhere as to these different practices prevailing at Cleveland and Buffalo, and they are the real parties to the transportation contract.
>
> "The complainants contend that they are discriminated against in that all inbound freight consigned to certain firms, or in the care of certain teamsters, is segregated and placed in one location in the freight warehouse or on the pier where it may be readily obtained, whereas freight consigned to other persons or firms is not so segregated, but is placed in the sections with other merchandise. In answer to this the carriers explain that some consignees receive daily a volume of freight so large that if spread out over the station floors by commodities or carloads so much floor space would be required as to materially retard the delivery of freight to the public generally. In order to expedite the handling of the freight, as well as to conserve the floor space, the carriers have accepted the practice of segregating the shipments intended for the consignees or teamsters who receive daily a considerable volume of freight and who undertake to remove it early each morning. There is no discrimination in this practice, however, for the evidence shows that any consignee or teamster who is able and willing to observe the requirements as to volume of traffic and prompt removal of goods may have his freight so segregated if he desires. In our judgment this is a reasonable practice, resulting not only to the advantage of the defendants through efficiency of station operation, but also to the general public and the teamsters who, under the prevailing system, are obliged to go upon the station platforms to obtain their goods.
>
> "The complaints respecting the defendants' methods of receiving outbound package freight refer particularly to the so-called peddling system, in operation at a few of the stations. This system is described by counsel for the complainants as meaning the distribution from door to door, and from pile to pile at the same station, merchandise intended for different consignees along the same route. This allegation lacks force. It appears that outbound freight is despatched on trains operating on regular schedules and departing soon after the published closing time of the stations; the plan of partial segregation complained of has been found necessary in order that such freight may be forwarded the same day that it is received. The necessity for some such arrangement is obvious, for the record indicates that during the last hour and a half of the day more than 50 per cent of the outbound freight is received at the stations, the greatest rush being from 4 to 4:30 in the afternoon. If freight for all destinations were dumped indiscriminately at every receiving doorway, it would be manifestly impossible for the carriers at some of their stations to separate and load it into the proper cars between the time it is received and the time the trains depart.
>
> "Upon a full consideration of all the facts of record, including numerous exhibits introduced by the complainants to substantiate their charges of unreasonable delay to teamsters, we are of the opinion that the methods which have been adopted by the defendants herein for the receipt and delivery of package freight are reasonable and nondiscriminatory, and have been formulated through the experience gained in the operation of each individual station. It would appear that the teamsters and shippers are themselves responsible for much of the delay, in that the hauling to and from the stations is not more uniformly done throughout the day. The practice of hauling inbound freight in the early morning hours and outbound freight during the late afternoon results in congestion that would be greatly relieved if the hauling were distributed more evenly.
>
> "In view of these conclusions the jurisdiction of the Commission and the power of the complainants to invoke that jurisdiction need not be discussed at length. It is sufficient to call attention to the fact that the complainants, acting in the capacity of draymen, have no interest in the goods transported nor in the payment of the transportation charges. As we said in New York Team Owners' Asso. vs. S. P. Co., 12 I. C. C. 204, 208:
>
> "'It is by no means clear that a person or company engaged in draying goods to a station is entitled under the act to complain on his or its account of a preference granted by a carrier to another person or company engaged in a like business, neither the complainant nor the preferred drayman being shippers or having any interest in the rate or service rendered by the carrier.'
>
> "It follows from what has been said that the complaints must be dismissed."

Conditions as revealed by the New York, New Jersey Port and Harbor Development Commission's clockings and other observations are much the same as in 1914 except in the matter of peaks at the freight stations. The Interstate Commerce Commission found that 50 per cent of the outbound freight was received at the station during the last hour of the end of the day, the greatest rush being from 4 to 4.30 in the afternoon. The Railroad Administration, by its regulations, was able to change the situation materially in this respect, with the result that the railroad clockings made in 1918 showed the peaks for outbound freight as occurring between 10 and 11 a. m. and between 2 and 3 p. m.

STORE-DOOR DELIVERY

In 1918, largely through the efforts of Mr. James F. Harlan, member of the Interstate Commerce Commission, an attempt was made to establish something much more radical than tailboard delivery; namely, store-door delivery. Store-door delivery involves the loading of inbound freight upon drays by the carriers immediately upon arrival, and the delivery of it forthwith to its final destination, this service being charged for at an established rate. The complement to this is store-door collection, by which the shipper notifies the carrier that he has goods for it and a dray operating on a regular schedule calls for it.

The movement met with much opposition on all hands, from merchants, carriers and truckmen. The time is evidently not yet ripe for it. Store-door delivery from existing terminals on the Manhattan side of the river would be difficult. It will be feasible from the inland terminals called for by the automatic-electric system, but the service must start small and prove itself economic and attractive to both the merchant and the truckman. The merchant should have the option of having the delivery and service collection covered by his freight rate or having it omitted from the freight rate with a privilege of delivering and collecting with his own trucks.

Conclusion

Summarizing the trucking investigation, the outstanding fact is that present methods are wasteful all along the line. The trucks are in general underloaded, they meet with unnecessary delays at every point where they receive or deliver goods, they travel on the streets at an unnecessarily low average rate of speed and they travel unnecessary distances.

Some of the waste will be automatically eliminated by the adoption of the more rational terminal system recommended by the Commission. Some of it can be eliminated by other changes recommended by the Commission — consolidation of trucking interests; better co-ordination of effort between merchant, truckman and carrier; better regulation of street traffic; better ferry schedules. But with all of these improvements much of the opportunity for reduction of the trucking losses rests outside of the control of any port authority, rests squarely with the merchant, the manufacturer and the truckman. Only by the voluntary co-operation of all concerned can the vast losses of the present system be reduced to a reasonable minimum.

CHAPTER 18

Warehousing

Goods passing into, out of or through the Port of New York may move almost continuously within the Port District via car, vessel or truck, but more frequently the movement is arrested by a storage period of greater or less length. Perishable foodstuffs coming in large quantities in their seasons must be held in cold storage for the seasons in which they do not come. Goods shipped into the Port and goods produced within it are held awaiting favorable markets. Freight brought by the railroads for export must often be stored temporarily awaiting shipment. Raw materials are stored pending their use for manufacturing purposes. The 688 public warehouses, with their 24,905,490 sq. ft. of available floor area — not taking into account warehouses devoted exclusively to storing household goods, or the large plants built by the Federal Government during the war — found by the Commission to be in operation in 1918 within the Port District attest the volume of storage required at the Port.

The facilities leave much to be desired, particularly in the matter of location. New Jersey has far too few warehouse facilities, as have the Bronx and Queens. Manhattan's facilities are divided among many scattered plants, few of which have direct water access. As to equipment, while there are exceptions to this statement, there is a general deficiency of machinery needed for the most economical operation of the warehouses.

HOW WAREHOUSING WAS STUDIED

Two general methods of attack were followed in the study of warehousing. A questionnaire was sent to warehouse owners asking information as to the character of buildings, storage capacity, handling facilities, rates and the like, and an investigator supplemented this by personal visits to the warehouses. A more detailed study, covering the volume and commodities handled in definite periods, precise methods of handling, operating costs, warehouse rates and the design of the buildings and facilities, was made from the records of several of the largest warehouse companies, whose officers kindly placed the records at the disposal of the Commission's investigators.

GENERAL WAREHOUSE FACILITIES AT THE PORT

Nearly all of the warehouse owners returned the questionnaire forms, although in the majority of cases the more intimate questions were not answered. The questionnaires were sent out in the autumn of 1918, and the returns reflect conditions in the latter part of 1918 and first part of 1919. The war had at that time caused abnormal demands for warehousing facilities, and all kinds of buildings designed for other purposes had been pressed into warehouse service — old factory buildings, stables, breweries, school houses and in one instance a large baseball stand.

Table 1 indicates as nearly as can be determined from 257 returned questionnaires the number of warehouses and their available floor area within the Port District at the close of the year 1918. Sharp lines of demarcation could not be drawn between the three groups, and the third, general merchandise, doubtless covers some food not listed under the preceding head. Other questionnaires were disregarded for the reason that the warehouses were found to store household goods only, but in this respect also it was not always possible to draw a sharp line.

In addition to the warehouses in Table 1, the United States Navy Department during the war erected in Brooklyn on Second and Third Avenues from Forty-third to Forty-fourth Street and at the New York Navy Yard a total of seven large warehouses with floor space amounting to about 3,000,000 sq. ft., these plants being known as the Fleet Supply Base, and the War Department completed the Army Supply Base at First Avenue, Brooklyn, from Fifty-seventh to Sixty-third Street, with piers and nearly 4,000,000 sq. ft. of warehouse space.

TABLE 1 — PUBLIC STORAGE WAREHOUSES IN THE PORT OF NEW YORK LATE IN 1918 AS INDICATED BY THE RETURNS FROM THE COMMISSION'S QUESTIONNAIRE*

	Cold storage		Food storage other than cold		General merchandise†		All classes	
Location by districts	Number of warehouses	Floor area, square feet	Number of warehouses	Floor area, square feet	Number of warehouses	Floor area, square feet	Number of warehouses	Floor area, square feet
Manhattan	18	1,492,075	32	720,881	205	7,971,979	255	10,181,935
Brooklyn	11	380,000	28	1,234,838	295	9,342,874	334	10,957,712
The Bronx	1	171,434			2	28,500	3	199,934
Queens					7	182,000	7	182,000
Staten Island					52	1,130,778	52	1,130,778
Total New York	30	2,043,509	60	1,955,719	561	18,656,131	651	22,655,359
Newark	2	86,884			16	791,395	18	878,279
Jersey City	11	906,700	1	129,352	3	90,000	15	1,126,052
Hoboken					2	220,000	2	220,000
Passaic					1	10,800	1	10,800
Harrison					1	15,000	1	15,000
Total New Jersey	13	993,584	1	129,352	23	1,127,195	37	2,250,131
Grand total	43	3,037,093	61	2,085,071	584	19,783,326	688	24,905,490

* Warehouses handling only household goods were disregarded.
† Includes some food storage not included in the second group.

The location of the warehouses in the Port District are shown on Fig. 11 of Part IV. Symbols on these maps indicate the character of goods stored, corresponding to the three groups in Table 1.

Inspection of the map will show among other things that more than 90 per cent of the warehouses of Brooklyn, Queens, the Bronx and Staten Island are located on the waterfront in the immediate vicinity of the commercial and industrial shore development; that in Manhattan more than 90 per cent of the warehouses are near the commercially developed shore, but more remote from it and with more trucking necessary between pier and warehouse than in Brooklyn or Staten Island; that in the main in Greater New York the cold-storage warehouses are in the immediate vicinity of the market centers; that in New Jersey warehouse locations seem to be governed about equally by water and rail access, and that the district lying west of the Hudson and Upper Bay, with direct rail access from all but three of the principal railroad systems of the Port, has less than 14 per cent of the Port's warehouses.

A closer study of the Port's warehouses than is possible to make from the small-scale maps reveals, as might be expected of an unsystematic growth, that while in the main warehouse location and design has been governed by the purposes which the warehouses serve, the details are faulty and the warehouses are too remote from the waterfront, which results in excessive trucking, lighterage and handling costs and in great congestion.

Whip Hoists and Trailers Transferring Freight from Steamer to Warehouse — Bush Terminal

New York Dock Company

Among the various studies of warehouses conducted by the Commission's staff, two were made at the largest warehouse groups, those of the New York Dock Company and the Bush Terminal Company.

The property of the New York Dock Company is situated on the Brooklyn waterfront between Fulton Ferry and Erie Basin, extending about 14,000 ft. or 2.65 miles along the waterfront. Except for the waterfront occupied by the South and Hamilton ferries and that at Red Hook owned by the Grace Steamship Company, a total of about 1,500 ft., the property is continuous. Thus a waterfront of some 12,500 ft. is controlled by the company.

On this property are 33 piers, all but two of which are covered. They have an area of 2,115,989 sq. ft. With a few exceptions their safe floor load is given as 400 or 500 lb. per square foot. Back of the piers the property of the company extends from 200 to 1,300 ft. from the bulkhead and is cut by many streets. On this upland property are 148 buildings used for warehouse purposes, nearly all within 600 ft. of the waterfront. In general they are built of brick with timber columns and floors. They stand in thirteen groups or sections, from two to five stories in height, more than half being four stories high.

These warehouses have a gross floor area of 5,176,826 sq. ft. and a volume of about 59,315,000 cu. ft. The story height from floor to floor is usually about 13 ft. for the ground floor and 11 ft. for

Tractor-Trailer Service at Bush Terminal — Note Drays Which Must Use Same Thoroughfare to Reach Steamship Piers

Table 2 — Subdivision of New York Dock Company Property

Designation of section	Number of warehouses	Total floor area, sq. ft.
Martins Stores	12	556,921
Roberts Stores	16	805,253
Prentiss Stores	11	264,027
Woodruff Stores	9	495,001
Columbia Stores	1	88,453
Robinson Stores	20	685,762
Union Stores	8	382,922
Masters Stores	7	292,659
R. & S. Stores	2	27,355
McCormick Stores	9	309,605
Clinton Stores	11	495,886
Governors Stores	29	475,342
Red Hook Stores	13	297,640
Total	148	5,176,826

the upper floors. The safe floor load varies from 200 to 300 lb. per square foot. Generally it is about 250 lb. per square foot.

The thirteen groups are designated as stores. The names by which they are identified, together with the number of warehouses and the floor area is each group, are shown in Table 2. The stores as listed in this table are in sequence from north to south.

Of the 148 warehouses, three have two stories, 28 have three, 86 have four and 31 have five. For each 1,000 ft. of waterfront there is a warehouse floor area of 414,103 sq. ft. and a pier area of 169,279 sq. ft. For each square foot of pier area there is therefore a warehouse floor area of 2.45 square feet.

There are three railroad float terminals with track delivery distributed along the property — the Fulton, Baltic and Atlantic terminals. Railroad tracks run in front of the majority of the buildings and on some of the piers so that freight cars can approach close to the structures; few if any of the buildings, however, are provided with platforms or other special facilities. The Governors and Red Hook stores at the southern end of the property are the only warehouses distant from the railroad tracks. These stores, however, are furnished with overhead carriers for handling cotton bales, and they receive the greater part of the cotton handled by the New York Dock Company.

Operation of Plant

With the exception of the open pier, the piers of the New York Dock Company are leased to and operated by steamship companies. Commodities of all kinds arriving via steamship, rail, lighter or truck are received, stored and forwarded.

About 80 per cent of the goods stored arrive via steamship, mostly through the New York Dock Company's piers, but some also by truck from steamships docking at other piers, and some by rail and lighter. The records of the receipts of commodities for August and September, 1919, indicate that 69 per cent were received across the piers and 22 per cent came by lighters.

Substantially all of the goods in storage are for domestic consumption. Some 20 per cent of the goods come from abroad, are stored in bonded warehouses and later reshipped to foreign ports. Among the commodities handled in this manner are chick peas, which come from Mexico in considerable quantities and are reshipped to Spanish ports. These reshipments usually leave the New York Dock Company by lighter. The stored commodities are largely foodstuffs. It is estimated that deliveries to the extent of 50 per cent are made to drays, the commodities to a large extent being for use or sale in this vicinity; 30 per cent, including the 20 per cent bonded for reshipment above mentioned, to lighters; and the remaining 20 per cent to railroad cars.

Under ordinary conditions practically no commodities are received at the warehouses for export, such goods being delivered directly to the piers. During the war, however, because of the scarcity of cargo space and the lack of sufficient storage space on piers, export goods were put into warehouses in considerable quantities to be ready for shipment at the first opportunity.

A number of the warehouses are bonded, and certain commodities not used in this country are received from abroad and stored until reshipped to other foreign ports. Quantities of tobacco and cigars and certain other imports are also stored until the owners ship them abroad or pay the duty and take them out of bond for domestic use.

Four-wheeled platform trucks, each drawn by a mule, are the principal means of movement from the wharves and bulkhead to the warehouses, although the company has a few tractors in use. Goods arriving by rail are also to a considerable extent unloaded to the platform trucks and drawn by mule to the warehouses.

The ground floors of the warehouses are reserved for heavy and bulky packages, for packages which cannot be easily hoisted to the upper floors and for goods not liable to injury by dampness. Goods are hoisted to the upper floors by electrically operated whip hoists on the outside of the buildings. Ten or twelve men are employed in a gang moving goods from cars, lighters and wharves to their places in the warehouse.

The available floor area varies from 75 to 83 per cent of the gross area according to the nature of the commodity and the number of lots and brands. The Commission believes 78 per cent is a fair average.

The average height of goods in storage is 6½ feet. Goods are not usually tiered more than 7 ft. high, and never more than 8 ft., as with higher tiering the cost would increase rapidly.

Commodities Handled

Insurance regulations and the cost of insurance govern the use of the several sections and stores. Examination of the books and inspection of the warehouses showed specialization of certain of the houses in certain commodities, though not to the complete exclusion of other commodities. For example, coffee and tea are stored mainly at the Martins and Roberts stores; cotton at the Governors and Red Hook stores, which are used almost entirely for that commodity; beans at the Robinson and Woodruff stores; tobacco at the Clinton, Robinson, Union, Woodruff and Martins stores, and to a lesser extent at the Roberts, Governors and Red Hook stores; wool at the Martins, Clinton, Robinson and Woodruff stores; chick peas at the Woodruff stores. All of these commodities are taken to some extent by all of the stores.

The following percentages of the principal commodities were found from the records to be in storage:

Uplands Between Warehouses and Piers of New York Dock Company — Railroad Cars, Drays and Mule-Drawn Trucks Handling Goods from Steamship to Warehouse, All Using Same Thoroughfare

Coffee, 37.8 per cent; cocoa, 22.4 per cent; cotton, 11.3 per cent; tobacco, 2.6 per cent; corned beef, 1.7 per cent; beans, 1.7 per cent; canned goods, 1.6 per cent; peas, 1.3 per cent; hides, 1.3 per cent; wool, 1.1 per cent. Nearly 75 per cent of the goods stored are foodstuffs.

As to the length of time goods are in storage, some are delivered almost immediately, while others are stored more than a year. The bulk of the goods, such as coffee and cocoa, move rapidly. No data have been compiled by the company as to the average storage period, but the records indicate that it is probably 1½ or 2 months.

RECEIPTS AND DELIVERIES

The receipts and deliveries at the warehouses have been analyzed for a period of nine months, from January 1 to September 30, 1919, inclusive. The records for the month of August and September have been analyzed separately from those of the seven preceding months. The figures are summarized in Table 3.

During the nine months under investigation there were delivered from the warehouses 89 different commodities individually classified, besides many other commodities classified as general merchandise. The total weight delivered was 591,553,754 lb. This was made up as follows: Food products, 422,944,763 lb., or 71.5 per cent of the total; classified non-food products, 148,006,617 lb., or 25.0 per cent of the total; general merchandise, 20,602,374 lb., or 3.5 per cent of the total.

Table 4 gives, in order of total weight, the kind of packages or containers, the weight per package, the number of packages delivered and the weight delivered, of 40 of the 89 commodities and also of the miscellaneous goods classified as general merchandise, which come fourth in the list. The other 49 commodities making up the total of 89 are grouped at the bottom of the table.

From this table it will be seen that coffee constituted more than one-third of all of the weight delivered, and

TABLE 3 — RECEIPTS AND DELIVERIES, FROM JANUARY TO SEPTEMBER, 1919, INCLUSIVE AT WAREHOUSES OF NEW YORK DOCK COMPANY

	Total number of packages	Average number per month	Number per working day	Total weight, lb.	Weight per month, lb.	Weight per working day, lb.	Average weight per month, lb. per sq. ft. of gross floor area	Average weight per package, lb.
			Receipts					
January–July (7 months)	2,140,497	305,785	11,958	333,744,590	47,677,798	1,864,495	9.2	156
August		367,890	14,150		61,006,174	2,346,391	11.6	166
September		441,387	17,655		66,037,647	2,641,506	12.8	150
January–September (9 months)	2,949,774	327,753	12,825	560,788,411	51,198,712	2,003,428	9.9	156
			Deliveries					
January–July	3,098,150	442,593	17,308	492,770,715	70,395,818	2,752,909	13.6	159
August		324,359	12,475		52,313,673	2,012,064	10.1	161
September		285,287	11,419		46,469,366	1,858,774	9.0	163
January–September	3,707,796	411,977	16,121	591,553,754	65,728,195	2,571,973	12.7	160

TABLE 4 — DELIVERIES FROM WAREHOUSES DURING JANUARY TO SEPTEMBER, 1919, INCLUSIVE, NEW YORK DOCK COMPANY

			Weight per package			Packages delivered		Weight delivered	
No.	Commodity	Kind of package or container	Minimum	Maximum	Average	Total number	Per cent of all packages	Total, lb.	Per cent of all commodities
1	Coffee	Bags, mats	75	250	141	1,586,629	42.80	223,638,972	37.80
2	Cocoa	Bags, cases	106	250	172	768,457	20.73	132,520,199	22.44
3	Cotton	Bales, rolls	100	550	531	125,558	3.39	66,757,275	11.28
4	General merchandise	Cases, barrels, bales, bags	5	1,500	167	123,348	3.33	20,602,374	3.48
5	Tobacco	Bales, cases, seroons, hogsheads	100	1,800	225	68,918	1.86	15,496,180	2.62
6	Corned beef	Cases	40	110	54	184,720	4.98	9,968,880	1.69
7	Beans	Bags	100	500	134	73,135	1.97	9,828,140	1.66
8	Canned goods	Cases	50	200	75	123,081	3.32	9,289,575	1.57
9	Peas	Bags	100	220	204	36,868	0.99	7,500,570	1.27
10	Hides	Bales, bundles, loose	25	1,400	513	144,614	3.90	7,412,661	1.25
11	Wool	Bales	200	1,200	481	13,758	0.37	6,615,825	1.12
12	Sugar	Bags, mats	50	323	86	70,788	1.91	6,087,200	1.03
13	Dates	Boxes	80	80	80	69,345	1.87	5,547,600	0.94
14	Rubber	Cases, bags	50	1,000	314	16,274	.44	5,122,750	0.86
15	Paper	Bundles, rolls, cases, crates	300	1,500	668	6,290	.17	4,184,750	0.71
16	Rice	Bags	100	250	127	32,711	.88	4,162,066	0.70
17	Tin	Cases	115	220	212	18,952	.51	4,013,725	0.68
18	Tea	Cases, chests	50	400	127	25,567	.69	3,248,650	0.55
19	Nuts	Bags, boxes	50	300	175	18,248	.49	3,189,295	0.54
20	Iron and steel	Crates, bundles	500	1,200	308	8,691	.23	2,680,000	0.45
21	Cocoanuts	Bags, cases	65	200	167	14,129	.38	2,362,696	0.40
22	Chickle	Bags	150	300	191	8,476	.23	1,619,350	0.27
23	Brulap	Bales	400	1,200	863	1,873	.05	1,618,500	0.27
24	Cocoanut oil	Barrels	300	600	450	3,575	.10	1,608,750	0.27
25	Honey	Barrels	100	1,000	577	2,774	.0[illegible]	1,600,250	0.27
26	Fertilizer	Bags	50	300	153	10,456	.28	1,598,700	0.27
27	Ixtle	Bales	200	300	300	5,311	.14	1,593,300	0.27
28	Wood pulp	Bales	350	450	400	3,883	.10	1,553,200	0.26
29	Seeds	Sacks, bags	100	300	171	8,935	.24	1,530,725	0.26
30	Potash	Casks	1,000	1,500	1,250	1,198	.03	1,497,500	0.25
31	Lintils	Bags	100	250	214	6,916	.19	1,478,175	0.24
32	Skins	Bales	50	1,200	405	3,345	.09	1,358,875	0.23
33	Gum	Sacks, bales	100	1,000	227	5,989	.16	1,357,500	0.23
34	Leather	Bales, cases	200	1,000	469	2,848	.08	1,334,450	0.23
35	Shoes	Cases	300	450	375	3,426	.09	1,284,750	0.22
36	Pelts	Casks	600	1,000	898	1,422	.04	1,278,300	0.22
37	Fish	Cases, barrels	50	600	95	13,283	.36	1,262,120	0.21
38	Casein	Bags	100	150	125	10,083	.27	1,260,375	0.21
39	Hemp	Bales	150	1,000	462	2,701	.07	1,244,410	0.21
40	Wire	Coils	100	750	241	4,821	.13	1,167,650	0.20
41	Other commodities (49)	Various	15	2,330	184	*76,400	2.06	†14,077,491	2.37
	Total, all commodities		15	2,330	160	3,707,796	100.00	591,553,754	100.00

* Average number of packages per commodity 1,559, minimum number 76, maximum number 7,582.

† Average weight per commodity 287,294 lb., minimum weight 16,500 lb., maximum weight 866,225 lb.

that three commodities, coffee, cocoa and cotton, constituted more than two-thirds. The table also shows a preponderance for coffee and cocoa in the number of packages, cotton falling below two other commodities because of the large weight per package.

Table 5 shows the relative number of packages of different weights or within specified weight limits, irrespective of the commodities they contained. By far the largest group is that from 125 to 149 lb., this group including the 132-lb. bags of coffee.

The seasonal variation of receipts and deliveries of coffee, cocoa, cotton and beans for ten months of the year are shown in the series of charts, Figs. 1–4. They show the wide fluctuations to be expected in the receipts, and much narrower fluctuations in the deliveries, corresponding to fairly uniform rates of consumption.

On the first of each month what is designated a room report of storage is made, which shows the total area of floor space, that unavailable, that occupied and the percentage of available space occupied. The percentages for the period from June 1, 1915, to November 1, 1919, are indicated in Table 6 and Fig. 5.

TABLE 5 — NUMBER OF PACKAGES OF DIFFERENT WEIGHTS DELIVERED DURING JANUARY TO JUNE, 1919, INCLUSIVE, NEW YORK DOCK COMPANY

	Packages delivered			Packages delivered			Packages delivered	
Weight of packages, lb.	Number	Per cent of total	Weight of packages, lb.	Number	Per cent of total	Weight of packages, lb.	Number	Per cent of total
25–49	[1]141,819	3.83	375–399	9,105	0.25	725–749	....	....
50	166,398	4.49	400	10,508	0.28	750–774	939	0.03
75–99	[2]329,651	8 89	425	28	....	775	....	....
100–124	[3]177,292	4.78	450	18,600	0.50	800	401	0.01
125–149	[4]1,496,181	40.35	475	1,505	0.04	825–849	....	....
150–174	[5]251,742	6.79	500	38,658	1.04	850–874	....	....
175–199	[6]568,314	15.33	525	1,440	0.04	875	1,083	0.03
200–224	228,045	6.15	550	91,484	2.46	900	1,558	0.04
225–249	[7]75,541	2.04	575–599	....	....	925	82	....
250	37,850	1.02	600	6,145	0.16	950	321	0.01
275–299	26,303	0.72	625	2,001	0.05	975–999	....	....
300	5,621	0.15	650	806	0.02	1000–2330	10,612	0.29
325	2,661	0.07	675–699	....	....			
350	1,788	0.05	700	3,315	0.09	All packages	3,707,797	100.00

[1] Includes 128,226 packages (3.5% of total) weighing 37½ lb. each

[2] Includes 309,523 packages (8.3% of total) weighing 75 to 80 lb. each

[3] Includes 96,796 packages (2.6% of total) weighing 100 lb. each

[4] Includes 1,442,033 packages (38.8% of total) weighing 132 lb. each

[5] Includes 250,417 packages (6.7% of total) weighing 150 to 154 lb. each

[6] Includes 528,672 packages (14.2% of total) weighing 180 lb. each

[7] Includes 74,387 packages (2.0% of total) weighing 225 lb. each

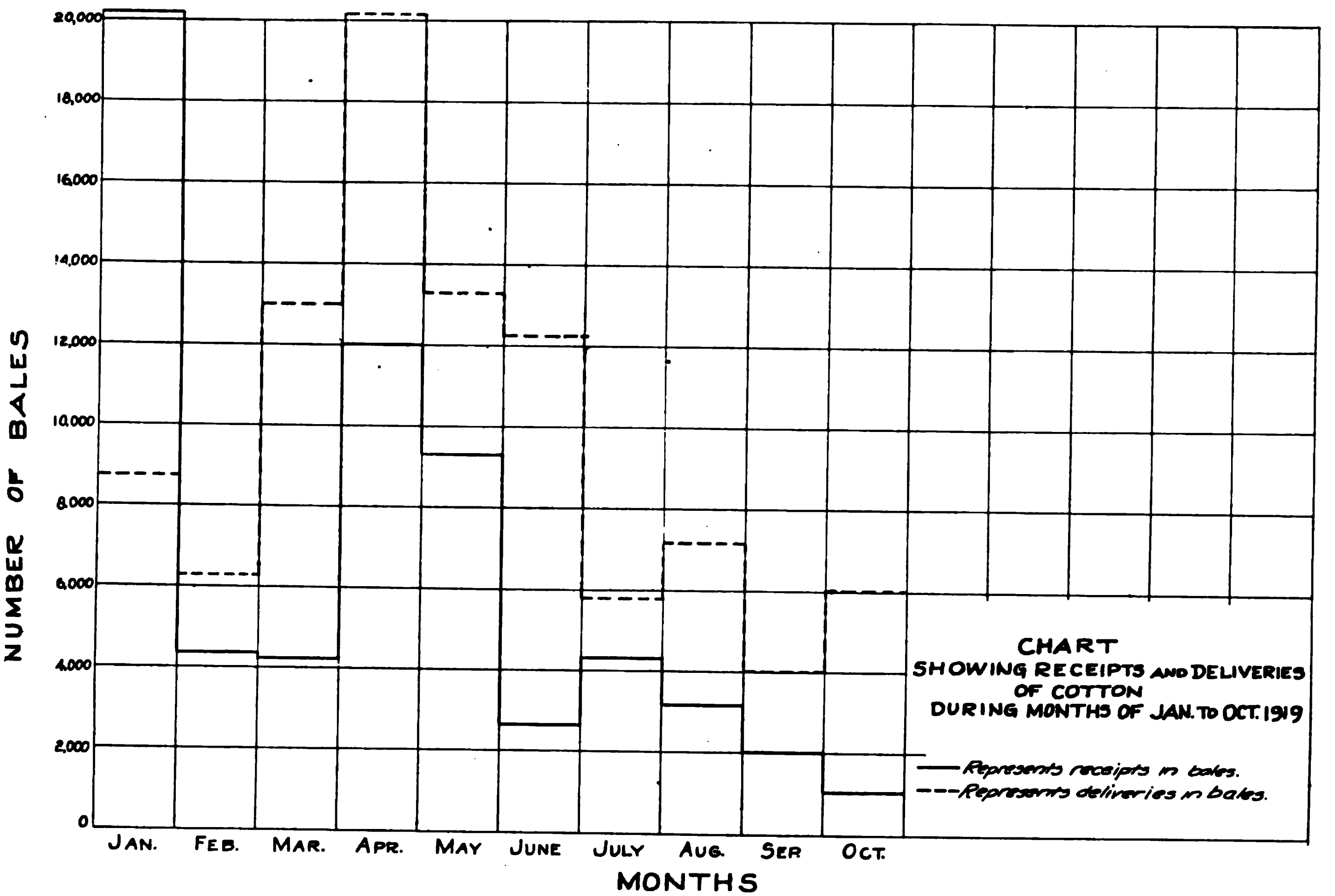


FIG. 1 — Receipts and Deliveries of Cotton by Months, January to October, 1919

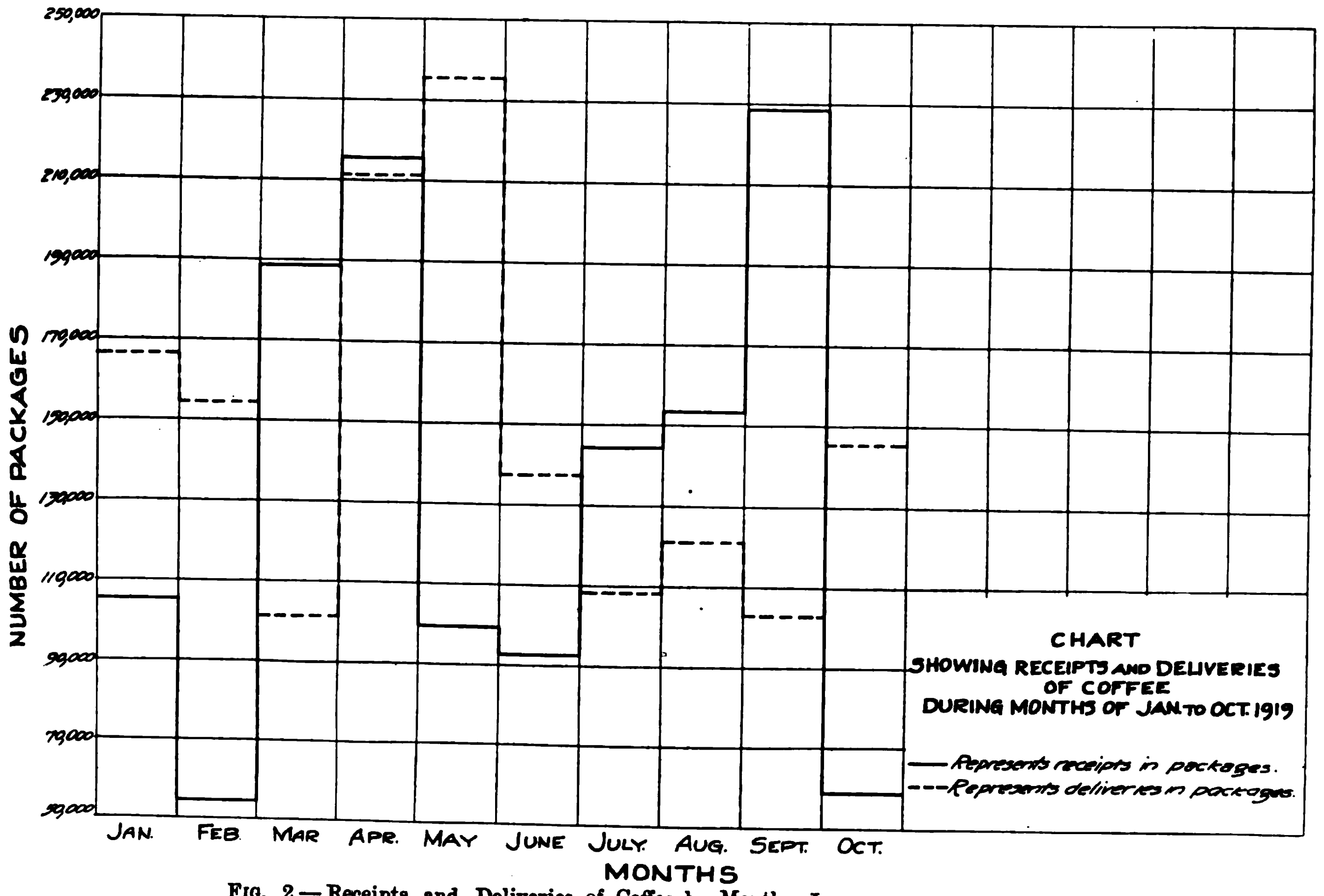


FIG. 2 — Receipts and Deliveries of Coffee by Months, January to October, 1919

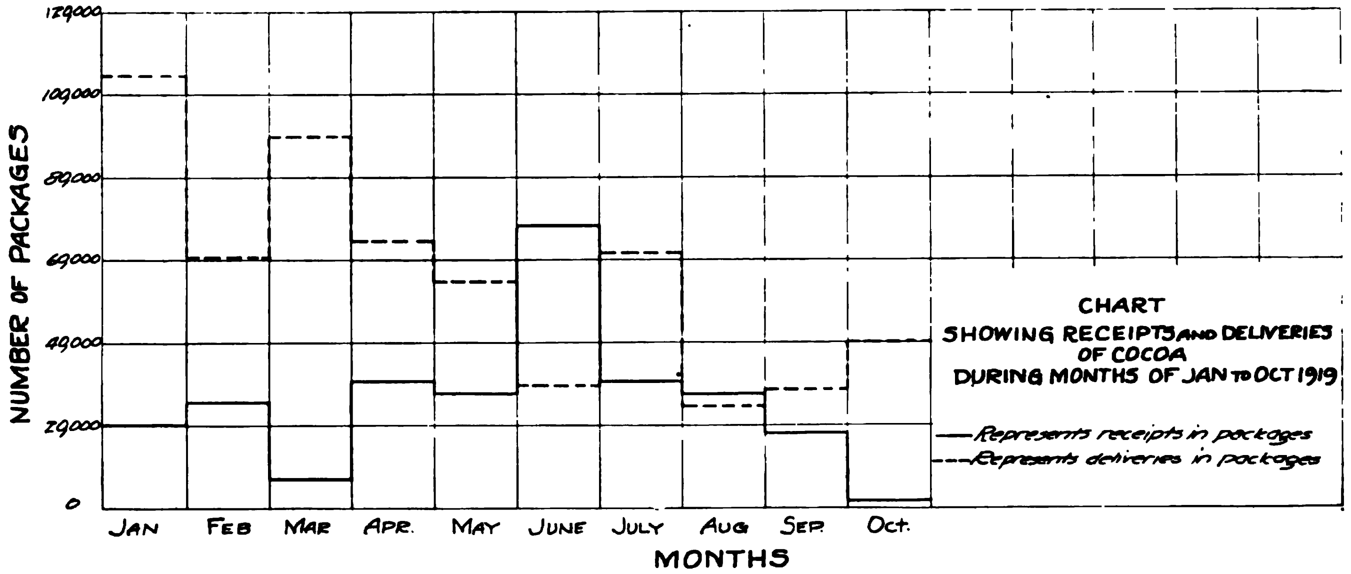


Fig. 3 — Receipts and Deliveries of Cocoa by Months, January to October, 1919

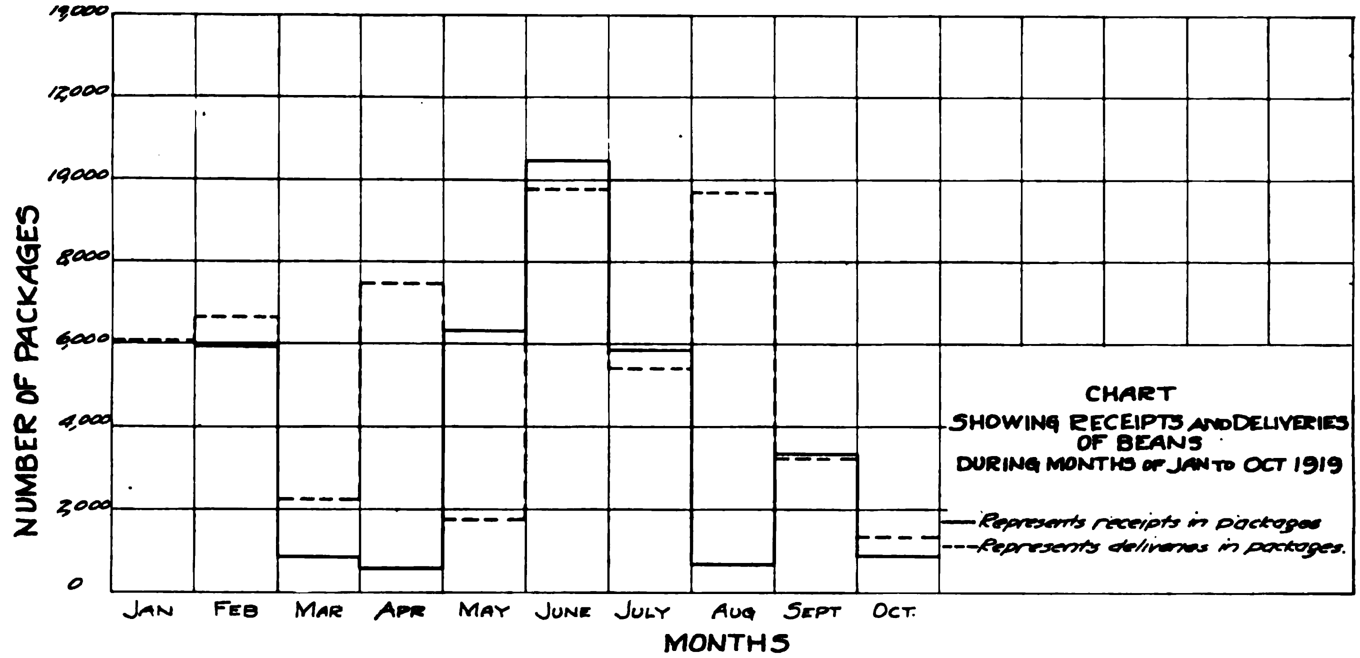


Fig. 4.— Receipts and Deliveries of Beans by Months, January to October, 1919

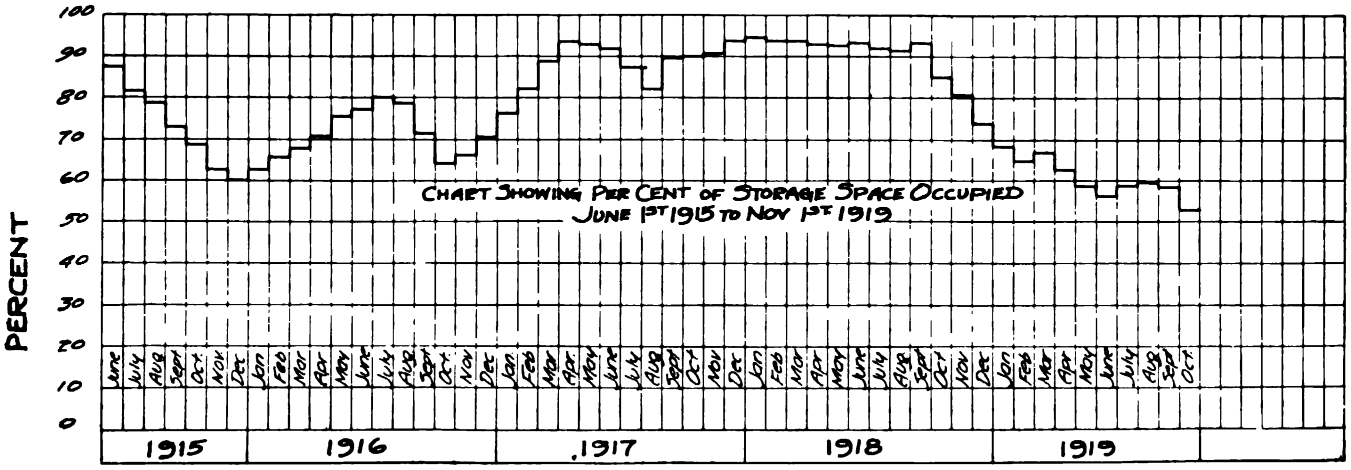


Fig. 5 — Percentage of Available Storage Space Occupied Each Month for Fifty-three Months, 1915–1919

TABLE 6 — PERCENTAGES OF OCCUPANCY OF SPACE AVAILABLE FOR STORAGE PURPOSES AT MONTHLY INTERVALS FROM JUNE 1, 1915, TO NOVEMBER 1, 1919, NEW YORK DOCK COMPANY

Date	Year				
	1915	1916	1917	1918	1919
January 1	....	60.00	71.55	93.3	73.5
February 1	....	62.55	75.81	94.4	68.2
March 1	....	65.41	81.56	93.8	64.7
April 1	....	67.53	88.17	93.8	66.7
May 1	....	70.15	93.15	92.7	62.6
June 1	78.28	75.11	92.84	92.4	58.7
July 1	80.78	76.95	91.58	92.9	56.1
August 1	81.51	79.83	87.25	91.67	58.4
September 1	78.49	78.60	81.40	91.18	59.3
October 1	72.66	71.34	89.40	92.9	58.2
November 1	68.75	63.59	89.57	84.5	53.0
December 1	62.37	65.96	90.20	80.5	....
Average	74.69	69.75	86.04	91.17	61.76

Shortly before our entry into the war the quantity of goods stored began to increase, and the percentages remained high up to the time of the signing of the armistice. Since then there has been a rapid falling off. The maximum occupancy during the war came February 5, 1918, when 94.4 per cent of the capacity was in use.

On September 1 and October 1, 1919, 17 per cent and 16.7 per cent respectively of the total floor area were not available for storage purposes.

Bush Terminal Company

The Bush Terminal Company occupies about 3,000 ft. of the Brooklyn waterfront, south of Thirty-ninth Street. It has eight shedded piers, one of which is double-decked, besides a small open pier. The total area of the piers is 1,563,736 sq. ft. and the floor area is 1,887,484 square feet.

Immediately behind these piers, separated by a roadway, are 28 warehouses from four to seven stories high, having a floor area of 1,575,000 sq. ft. and a volume of 17,458,835 cubic feet. These warehouses are provided with railroad car platforms in the rear. Except in the case of two of the most modern buildings designed for factory purposes, goods are handled entirely by whip hoists, the elevators that were installed having fallen into disuse. At the two modern factory buildings electric portable hoists have supplemented the elevators.

To the rear of these warehouses, extending back to a distance of 1,300 ft. from the bulkhead, are 90 additional buildings, mainly one story high, so that there are in all 118 warehouses, having a total floor area of 2,554,717 sq. ft. and a volume of 35,274,280 cubic feet. The floor area of the warehouses is 1.35 times the floor area of the piers.

Tables 7 and 8 list the warehouses and summarize the capacities of those of different heights.

Prior to the war all of the piers except the open ones were under lease to steamship companies. A considerable number of the warehouses, mainly the one-story buildings in the rear, were also leased to various corporations — approximately 27 per cent of the entire floor area. Soon after the entry of the United States into the war, the piers and warehouses were taken over by the Government for army use, and they are now being released to the Bush Terminal Company, floor by floor or building by building. The first space was returned to the company in April, 1919.

TABLE 7 — LIST OF BUSH TERMINAL WAREHOUSES, AND THEIR CAPACITIES

Warehouse numbers	Number of stores	Floor area, sq. ft.	Volume, cu. ft.
One Story			
11–13	3	21,180	428,895
17–19	3	42,341	952,673
20–22	3	35,136	737,856
23–30	8	59,163	1,242,423
31–38	8	59,311	1,244,531
87–94	8	66,610	1,398,810
63–70	8	59,163	1,242,423
71–78	8	59,211	1,243,431
79–86	8	59,963	1,259,223
95–103	9	70,000	1,470,000
104–117	14	110,030	2,310,630
118–122	5	25,354	532,534
14	1	7,500	151,875
Total	86	674,962	14,215,304
One Story and Basement			
15–16	2	30,000	408,750
Four Stories			
4–6	3	160,000	2,103,387
Five Stories			
1–3	3	200,000	2,580,068
Six Stories			
39–44	6	270,000	2,628,842
45–50	6	270,000	2,628,842
9–10	2	126,810	1,521,723
Total	14	666,810	6,779,407
Six Stories and Basement			
7–8	2	147,945	1,669,668
Seven Stories and Basement			
51–56	6	360,000	3,557,696
57	1	157,500	1,980,000
58	1	157,500	1,980,000
	8	675,000	7,517,696

TABLE 8 — SUMMARY OF CAPACITIES OF BUSH TERMINAL WAREHOUSES

Number of buildings	Number of stories	Floor area, sq. ft.	Volume, cu. ft.
86	One	674,962	14,215,304
2	One and basement	30,000	408,750
3	Four	160,000	2,103,387
3	Five	200,000	2,580,068
14	Six	666,810	6,779,407
2	Six and basement	147,945	1,669,668
8	Seven and basement	675,000	7,517,696
118		2,554,717	35,274,280

When the Commission's investigation of warehousing was undertaken twenty buildings, Nos. 23, 25, 28, 33 and 38–53 were being operated by the Bush Terminal Company for warehouse purposes, together with the three basements of buildings Nos. 54, 56 and 57, the upper floors of which were not under the company's control. The gross floor space in use was 794,526 sq. ft., 31.1 per cent of the gross floor area of the 118 warehouses, the gross volume in use being 8,115,721 cubic feet. The data that follow relate to those 20 warehouses and the three additional basements under the control of the Bush Terminal Company.

Table 9 shows the receipts and deliveries during eight working days — October 1 to October 9, 1919, inclusive — of those parts of the twenty-three ware-

TABLE 9 — RECEIPTS AND DELIVERIES FROM OCTOBER 1 TO OCTOBER 9, 1919 INCLUSIVE (EIGHT WORKING DAYS) AT THE TWENTY-THREE WAREHOUSES THEN PARTLY OR WHOLLY UNDER CONTROL OF THE BUSH TERMINAL COMPANY

	Receipts	Deliveries
Total number of packages	83,506	17,893
Average number per day	10,438	2,237
Total weight, pounds	11,841,766	2,788,692
Weight per day, pounds	1,480,221	348,586
Average weight per day, pounds per square foot of gross floor area	1,863	0.439
Maximum weight per package, pounds	1,700	1,500
Minimum weight per package, pounds	15	2½
Average weight per package, pounds	142	156

TABLE 10 — NUMBER OF PACKAGES OF DIFFERENT WEIGHTS RECEIVED AND DELIVERED DURING EIGHT WORKING DAYS, OCTOBER 1–9, 1919, INCLUSIVE, BUSH TERMINAL COMPANY

Weight of packages, lb.	Packages received		Packages delivered	
	Per cent	Number	Number	Per cent
20–25	4.07	3,396	88	0.49
25–50	7.86	6,554	154	0.86
50–75	0.10	82	398	2.23
75–100	0.26	216	508	2.84
100–125	2.91	2,423	3,528	19.72
125–150	75.57	63,128	8,784	49.10
150–175	3.35	2,792	1,490	8.33
175–200	0.26	216	1,114	6.23
200–225	1.32	1,102	423	2.36
225–250	0.64	535	251	1.40
250–275	...	...	132	0.74
275–300	0.11	91	63	0.35
300–325	0.27	228	113	0.63
325–350	0.01	6	5	0.03
350–375	0.13	112	303	1.69
375–400	...	4	11	0.06
400–425	0.42	354	72	0.40
425–450	0.10	83	114	0.64
450–475	0.26	219	...	...
475–500	1.64	1;363	2	0.01
500–525	0.06	52	39	0.22
525–550	...	...	...	...
550–575	...	...	...	...
575–600	0.05	44	...	...
600–625	...	...	13	0.07
625–650	0.01	8	...	...
650–675	0.01	7	...	...
675–700	...	...	...	...
700–725	...	...	15	0.08
725–750	...	...	...	...
750–775	...	1	17	0.06
775–800	...	...	...	...
800–825	0.25	206	...	...
825–850	...	...	1	...
850–875	...	1	...	...
875–900	...	...	...	...
900–925	0.02	14	...	...
925–950	...	...	1	...
950–975	...	...	...	...
975–1000	...	...	...	...
1000–1050	0.01	10	9	0.05
1100	0.07	59	...	...
1160	0.10	85	205	1.15
1275	...	...	3	0.02
1500	0.08	66	37	0.21
1610	...	1	...	...
1700	0.06	47	...	...
	100.00	83,505	17,893	100.00

houses then under the control of the Bush Terminal Company.

Records by commodities were not taken. The number of packages of various weights or weight groups received and delivered are indicated in Table 10.

Table 11 shows the percentages of occupancy of the various floors on October 3 and October 10, 1919. Table 12 assembles the information relative to the twelve 6-story warehouses, Nos. 39–50 inclusive, in a different manner, to show the degree of occupancy of floors collectively for the twelve houses.

No records are kept of the amount of trucking to and from the warehouses. The Bush Terminal through a subsidiary organization operates a motor-truck service, but 90 per cent of the business is handled by outside truckmen. The Bush Company, as well as other companies similarly situated, receives the greater part of the goods in storage from steamships which dock at the adjacent piers, and these goods are held in storage mainly for domestic consumption, and withdrawn as occasion demands. In normal times little or none of our domestic production is stored for shipment by steamship.

The principal commodities handled are coffee, cocoa, peas and beans, flour, rubber, tobacco and gums.

To obtain a correct idea of the business handled at these warehouses the receipts and deliveries should be ascertained for a considerable period, as receipts of many commodities are infrequent, and are likely to vary with the season. This is strikingly shown in the record for the 8-day period, when on account of a heavy and unusual receipt of flour, 62,370 bags weighing 8,731,800 lb. were put into storage. This was 74 per cent by weight of the entire receipts, while there were practically no deliveries of flour. On the other hand, coffee was distributed to the amount of 7,935 bags weighing 1,043,784 lb., or 37 per cent of the deliveries, while none was received.

The majority of warehouses on the waterfront are 150 ft. deep, this depth being apparently the usual

TABLE 11 — PERCENTAGES OF OCCUPANCY OF SPACE AVAILABLE FOR STORAGE PURPOSES OCTOBER 3 AND OCTOBER 10, 1919, BUSH TERMINAL COMPANY

Warehouse number	Number of stories available	Total gross floor area, square feet	Basement		Floor 1		Floor 2		Floor 3		Floor 4		Floor 5		Floor 6		Floor 7		Average	
			Oct. 3	Oct. 10	Oct. 3	Oct. 10	Oct. 3	Oct. 10	Oct. 3	Oct. 10	Oct. 3	Oct. 10	Oct. 3	Oct. 10	Oct. 3	Oct. 10	Oct. 3	Oct. 10	Oct. 3	Oct. 10
23	1	7,363	....	....	70	90	....	....	....	....	....	....	....	....	....	....	....	....	70	90
25	1	7,400	....	....	20	50	....	....	....	....	....	....	....	....	....	....	....	....	20	50
28	1	7,400	....	....	70	100	....	....	....	....	....	....	....	....	....	....	....	....	70	100
33	1	7,419	....	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	5	....
38	1	7,419	....	....	20	....	....	....	....	....	....	....	....	....	....	....	....	....	20	....
39	6	45,600	....	....	61	100	72	26	44	31	49	41	87	80	80	62	....	....	65.5	56.7
40	6	44,700	....	....	50	42	*46	*100	*	*73	49	46	44	38	28	26	....	....	36.1	54.2
41	6	44,700	....	....	58	58	*10	*10	28	23	20	13	31	23	23	15	....	....	28.3	23.7
42	6	44,700	....	....	50	42	85	75	*43	*100	*	*	20	28	10	8	....	....	34.7	42.2
43	6	44,700	....	....	42	54	20	18	15	15	*	*52	31	35	33	39	....	....	23.5	35.5
44	6	45,600	....	....	93	96	54	51	44	36	13	10	4	4	27	27	....	....	39.2	37.3
45	6	45,600	....	....	92	73	62	73	96	96	50	54	19	19	*	*21	....	....	53.2	56.0
46	6	44,700	....	....	69	65	77	85	54	58	*44	*100	19	23	*	*42	....	....	43.8	62.2
47	6	44,700	....	....	58	58	77	81	93	92	42	81	93	62	46	46	....	....	68.2	70.0
48	6	44,700	....	....	96	100	77	77	19	15	96	92	*43	*100	38	42	....	....	61.5	71.0
49	6	44,700	....	....	96	96	93	93	30	46	15	15	12	8	73	58	....	....	53.2	52.7
50	6	45,600	....	....	100	100	77	77	96	100	85	81	96	92	81	81	....	....	89.2	88.5
51	7 and basement	60,400	48	48	74	70	55	48	80	80	45	10	....	....	5	....	....	....	38.4	32.5
52	7 and basement	59,800	87	78	78	78	75	75	75	75	....	....	....	....	....	....	....	....	39.4	38.2
53	7 and basement	59,800	4	7	61	61	....	....	....	....	....	....	....	....	....	....	....	....	8.1	8.5
54†	Basement	7,475	44	30	....	....	....	....	....	....	....	....	....	....	....	....	....	....	44	30
56†	Basement	7,550	....	42	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	42
57†	Basement	22,500	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6

* Flour storage.
† Basement only in control of Bush Terminal Company.

TABLE 12 — OCCUPANCY OF TWELVE SIX-STORY WAREHOUSES BY FLOORS, BUSH TERMINAL COMPANY

Floor	Total gross floor area, sq. ft.	Total gross storage space, cu. ft.	Percentage of available space occupied		
			Oct. 3	Oct. 10	Average
1	90,000	876,280	72.1	73.7	72.9
2	90,000	876,280	62.5	63.8	63.2
3	90,000	876,280	46.8	57.1	52.0
4	90,000	876,280	38.6	48.6	43.6
5	90,000	876,280	41.6	42.7	42.1
6	90,000	876,280	36.6	38.9	37.7
Average	....	....	49.7	54.1	51.9

dimension for buildings receiving and delivering at the ends only. The height from floor to floor of the principal multi-story warehouse buildings varies from 9.74 ft. to 10.08 feet. The factory buildings which are here used for storage have a considerably greater story height, averaging about 13 feet.

The piles of goods in storage average 6½ ft. in height, the height being limited by the inability of a single gang to pile higher. A certain floor space, termed operating space, has to be allowed for working in, for handling, for doors and windows, and for getting at goods. This varies with the commodity and size of lots, shape and dimensions of buildings and the like. It is generally considered to run from 17 to 25 per cent of the floor area. In the case of flour it was found that walls and operating space required 19.7 per cent of the gross floor area, and that in storing coffee from 26.1 per cent to 31.3 per cent was unproductive, being taken up by walls and operating space.

COFFEE STORAGE

Brazilian coffee in 132-lb. bags is probably the commodity handled in the greatest quantity at these warehouses. Special coffee chutes for delivery to teams have been installed in several of the warehouses on the waterfront. Coffee is never stored in basements or floors at ground level. It is usually piled nine bags or about 7 ft. high. It is a commodity that comes in a great variety of brands or lots which it is necessary to get at individually, and a larger operating space is required than if they were of uniform character.

A working space from 8 to 12 ft. deep is left at the waterfront end of the building and a space 4 or 5 ft. wide is left across the rear end to keep windows, doors and chutes accessible. An aisle 4 or 5 ft. wide is left along one row of longitudinal columns and another longitudinal aisle of the same width along one side of the buildings, as well as a traverse aisle connecting the other two aisles. The gross area of a floor in the interior of buildings Nos. 39 to 50 is 7,450 sq. ft., and the net area inside the walls is 7,170 sq. ft. If we reserve 10 ft. in front, 5 ft. in the rear and two longitudinal aisles of 5 ft. each we deduct a total of 2,053 sq. ft. for operating space, leaving a productive area of 5,117 sq. ft. or 68.7 per cent of the gross area, 31.3 per cent being occupied by walls and operating space. Taking the minimum dimensions of operating space given — 8 ft. in front, 4 ft. in the rear and 4-ft. aisles — we have an operating space of 1,666 sq. ft., which may be regarded as a minimum. This leaves for productive use 5,504 sq. ft. or 73.9 per cent of the gross area. It is estimated that 8,000 and 7,500 bags of coffee can be stored in these maximum and minimum operating spaces respectively.

FLOUR STORAGE

Although flour is not one of the principal commodities handled at these warehouses, as ordinarily little of it is carried, occasionally a steamship will arrive bringing considerable quantities to be stored. This was the case at the time the operations were investigated, when a cargo of flour was put into storage which originated in the Middle West and arrived from San Francisco via the Panama Canal. The floors in various of the warehouses indicated in Table 11 as reserved for flour storage aggregate 74,650 sq. ft. in area or about 726,800 cu. ft. in volume. When filled to capacity about 10,200 140-lb. bags, aggregating 1,428,000 lb. of flour, can be stored on each of the ten floors.

Operating space on these floors reserved for flour is kept from storage use approximately as follows: A working space of from 8 to 12 ft., probably averaging 9½ ft., is allowed at the waterfront end of each floor to work in and to pass from one building to another. A space is left at the rear from 2½ to 5 ft. wide, probably averaging 3 ft., to get at the rear doors and windows. An aisle of about equal width is left to get from the front to the rear of the floor, and the bags are kept about 8 in. from the walls. In an inside area of 7,170 sq. ft. this entire operating space is 1,193 sq. ft. in area, leaving a net area for productive use of 5,977 sq. ft. on each floor.

The bags of flour are usually stored eight bags or 7 ft. high. This is about as high as a gang can store, and to pile higher would entail additional labor cost.

The volume of full occupancy per floor is 41,839 cu. ft. against a gross volume floor to floor of 72,563 cu. ft. — full occupancy being 57.7 per cent of the gross volume. Full occupancy of the floor area is 80.3 per cent of the gross area of building, operating space and walls taking 19.7 per cent of the area.

Table 13 shows collectively the receipts of flour at the ten warehouse floors confined to the storage of flour during the week of October 3-9, 1919. It also shows that there were no deliveries, and that the percentage of floor space occupied increased from 18.6 to 59.8 in the one week. The total capacity of the space is 102,000 bags or 14,280,000 lb. Loaded to full capacity, this would give a weight of 199 lb. per square foot over the entire area within the walls, or 239 lb. per square foot

TABLE 13 — RECEIPTS AND DELIVERIES OF FLOUR DURING WEEK OF OCTOBER 3-9, 1919, BUSH TERMINAL COMPANY

	Number of bags		Total weight, pounds		Percentage of floor space occupied
On hand Oct. 3		18,660		2,612,400	18.6
Received Oct. 4	7,080		991,200		
Received Oct. 6	13,710		1,919,400		
Received Oct. 7	10,440		1,461,600		
Received Oct. 8	11,370		1,591,800		
Received Oct. 9	1,110		155,400		
Total receipts, Oct 4–9		43,710		6,119,400	
Deliveries, Oct. 4–9		......		......	....
On hand, Oct. 10		62,370		8,731,800	59.8

of available area. There would be 1.70 packages per square foot of available area.

During this period the average receipts were 8,742 bags or 1,223,880 lb. per working day, and the maximum receipts were 13,710 bags and 1,919,400 lb. This latter was 13.4 per cent of the storage capacity.

ALL COMMODITIES

On October 3 the area occupied in the 23 warehouses by all commodities was 39.62 per cent of the available area. On October 10 it was 45.53 per cent, so that the average percentage of occupancy was 42.57 per cent.

The total receipts of all commodities for the period from October 1 to October 9 were 83,506 packages, weighing 11,841,766 lb., or a daily average of 10,438 packages weighing 1,480,221 lb., or 1,863 lb. per square foot of gross floor area. In the same period 17,893 packages weighing 2,788,692 lb. were delivered. The average deliveries per working day were 2,237 packages or 348,586 lb., equivalent to 0.439 lb. per square foot of floor area.

Leaving the heavy receipt of storage of flour entirely out of consideration, the average daily receipt was 388,746 lb. and the average daily deliveries 348,586 lb. The total floor area, deducting that reserved for flour, was 719,876 square feet.

The average weight of packages received was 142 lb. and the average weight of packages delivered was 158 lb. The minimum and maximum weights were 2½ and 1,700 lb. respectively.

General Deductions From Warehouse Studies

Certain general deductions can be made from the warehouse studies.

FLOOR WEIGHTS

Weights in pile, exclusive of aisle space, of four of the commodities stored in largest quantities are found from the warehouse study to be as follows:

Coffee, seven to nine bags high	150–200 lb. per square foot
Cocoa, six bags high	200 lb. per square foot
Beans, six to nine bags high	200–250 lb. per square foot
Flour, eight bags high	239 lb. per square foot

The foregoing figures are appreciably less than the actual weights per cubic foot of package would indicate. This is due to interstices in the pile. Where the weights of commodities in pile are not ascertainable they may be approximated at 90 per cent of the actual cubic-foot weight of the packages.

Chapter 7, "Shipping Facilities, Methods, Tonnages and Costs," gives tables of measurement and weight of a large number of commodities.

The records of the New York Dock Company make possible an approximation of the average floor weight per square foot of available area occupied during a period of nine months by more than 65,000 short tons of stored goods. The gross area in this case is 5,176,826 sq. ft., and the available area 4,037,924 sq. ft. or 78 per cent of the gross area. The room report shows a reduction of 15.3 per cent of the available area occupied during the nine months and the records show an excess of deliveries over receipts during the same period of 130,765,543 lb. The average height of pile is 6½ ft. It can be deduced from this that 212 lb. is the average weight per square foot of actual occupied space and 32.6 lb. the average weight per cubic foot of pile.

It should be noted that the New York Dock Company's business is mainly incoming ship cargoes, much of which can be stored in bulk. Warehouses receiving different classes of goods which would have to be stored in "Assortment" or "Individual Package Delivery" would have different average weights in the pile.

No general rule can be laid down for floor design. The warehouse must fit the business.

DISTANCES BETWEEN FLOORS

For general warehouse practice where goods are likely to be stored in "Bulk," "Assortment" and for "Individual Package Delivery," and where the "Standard Pile" does not exceed 8⅓ ft. in height, a floor-to-floor height of 8⅓ ft. plus 2 ft. for a sprinkler system plus the depth of the requisite floor system is suggested. (A "Standard Pile" in warehouse practice is a pile containing the greatest quantity of a commodity that can be practically stored in bulk, not exceeding 8⅓ ft. high nor 250 lb. per square foot of floor space occupied.)

High tiering is usually not desirable except for special commodities, and in general practice floor area and not volume is the desideratum.

HEIGHT OF BUILDING

There is no general rule for the height of a warehouse. The character of the business, the available capital, the subsurface conditions and many other elements govern.

Without elevators and with whip-hoist service as at present designed five stories seems to be the maximum feasible. With modern elevators properly located it is difficult to fix a limit. The army base warehouses in Brooklyn, nine-story buildings with a total of about 4,000,000 sq. ft. of floor surface, are served by 72 micro-leveling "operatorless elevators" with capacities of 10,000 lb., speeds of 100 ft. per min. and platforms 9 ft. 4 in. x 17 ft. in the clear, intended to carry four trucks.

ELEVATOR LOCATION

Elevator location is dependent on the business and operating methods of the warehouse. If hand trucking is to be used exclusively the elevators should if possible be spaced to limit the trucking leads to 50 feet. If tractors and trailers are to be employed their lines of travel should be analyzed in advance and the elevators so located as to avoid train fouling and provide ample turning space for the truck trains at both the entrances and the exits. The relation between labor, investment and tonnage to be handled will determine the number of elevators.

It seems probable that with improvements in elevator and tractor-and-trailer service the elevator will gradually replace the whip hoist or at least make it a subordinate equipment.

MACHINERY

Scales, elevators (vertical and inclined), whip hoists, chutes, barrel hoists, tractors, trailers, load-carrying trucks, hand trucks, conveyors and tiering machines all have their proper place in warehouses, the choice and amount of machinery again being governed by the character and size of the prospective business.

INSURANCE

As a rule the warehouseman insures the building, the customer the merchandise. Competition, however, dictates to the warehouseman the provision of proper safeguards against fires.

RECEIVING AND DELIVERY PLATFORMS

Many of the warehouses investigated lack platform space for drays, cars or both and offer no protection from the weather for merchandise entering or leaving the warehouse. Covered platforms 10 or 12 ft. wide flush with the warehouse floor and with the floor of the truck or car will save many foot-tons in freight handling, and many damage claims.

STREET CONGESTION

Narrow streets and unnecessary occupation of them by trucks serving many of the warehouses cause delays and extra cost to both the public and the warehouseman.

PERCENTAGE OF FLOOR OCCUPANCY

Available space as referred to in this resport is the area upon which goods can be piled; that is, the area remaining within the storage walls after the necessary entrance space and aisles have been deducted.

For goods stored in "Bulk" — that is, "Lot Unit" or quantity contained in "Standard Pile" — only the area of permanent entrance aisles required for economical handling between pile and door or by the fire regulations need be deducted, and the available space is usually 75 to 80 per cent of the interior area.

For goods stored in "Assortment" — that is, in lot-unit quantities of goods consisting of three or more varieties or sizes to be stored and accounted for separately — special entrance aisles must be provided in addition to the permanent aisles. This reduces the available space for bulk goods approximately one-third, leaving an available space of from 50 to 53⅓ per cent of the total space within walls.

In the case of "Individual Package Delivery" goods, which is "Assortment" carried to the extreme limit, while the additional aisles necessitate a reduction of the available space for bulk goods of approximately one-third and the available space is therefore 50 to 53⅓ per cent of the total space within walls, the height of the pile must be less than for goods in "Assortment" on account of its instability.

STORAGE RATES

Storage rates cover warehouse space required for one month or any fraction thereof, dating from the receipt of the first package. The rates are charged in advance from that date up to but not including the same date of the following month. When the expiring date falls on a Sunday or a holiday the next business day is the expiring day.

Rates are quoted by weight, by package, by volume and by area of floor occupied. There is no uniformity of charge, as the business is highly competitive. A rate apparently low may, however, be high when the cost of fire insurance to the customer is considered. A few rates are here given for goods not in bond: Beans in 100-lb. sacks, 9 to 10 cents for the first month, 4 to 5 cents for each successive month; coffee in 132-lb. sacks, 12 to 14 cents for the first month, 6 to 7 cents for each successive month; goods in cases, 2½ cents per cu. ft. for the first month, 1¼ cents per cu. ft. for each succeeding month. (The first month charge in the foregoing cases includes a charge for receiving and delivering.) On raw sugar, $1.25 to $1.28 per ton is charged for receiving and delivering and 80 cents per ton for each month in storage; on beans, 6 cents per 100-lb. sack for receiving and delivering and 5 cents per 100-lb. sack for each month in storage.

These rates are only quoted as illustrating present practices, which are so variable that the American Warehousemen's Association is engaged in an active effort to produce a standard basis on which to charge for storing and handling. This basis is intended to bring a uniform return per square foot of floor to the warehousemen, not to establish a uniform price. Their proposed rates for storage are to be based on floor space. Separate charges will be made for labor in handling and for extra service performed. The reader is referred to the pamphlets of the association if he cares to pursue this subject further.

HANDLING CHARGES

The subject of handling charges is so well set forth in the "Report of the Committee on Standardization of Basis for Rates" of the American Warehousemen's Association published in 1920 that a part of that report is here quoted substantially in full:

> The warehouse business has in many cases been very unprofitable in the past as a result of unintelligent competition due to an absolute lack of knowledge of the cost of handling merchandise.
>
> One of the most serious mistakes has been losing sight of the fact that there is a heavy overhead expense attached to handling operations. This oversight has practically made bankrupts of many warehouse concerns whose executives were experts on general storage problems and the handling of labor. . . .
>
> The unscientific method commonly used for estimating handling costs was to determine the actual cost of the *in* movement of the goods; an arbitrary amount for delivering (varying all the way from 50 per cent to 150 per cent of the *in* cost) was added as an estimate of the probable delivery cost and the price was then quoted slightly, if any, higher than the resultant figure. Nothing was added for overhead expenses or for additional service furnished.
>
> This method when wages of warehouse labor averaged 20 cents per hour made the handling rate appear to be about the same as the prevailing rates for storage. From this grew up the rough and ready idea of charging the same amount for handling as for one month's storage. Thus, the first month's charge would include the receiving and delivering of the merchandise and would be twice the charge for each succeeding month.
>
> Studies by experts have so far shown that the overhead expense is at least 125 per cent of the direct cost of laborers and checkers actually engaged in performing any particular handling operation.
>
> The old method was *in* cost plus estimated *out* cost, plus profit. The correct method is *in* and *out* cost plus overhead, plus profit. Ten to 25 per cent is a very conservative amount to add to the combined direct labor and overhead cost of handling, for profit.
>
> Wages have advanced to several times those paid since the old method of charging equal rates for storage and handling was first used. Taking into consideration these factors of increased wages, overhead expense and profit, it will be found that equitable handling rates may often be three or four times the rates shown in tariffs even now in use in some sections of the country.
>
> The absorption in the handling charge (usually billed with the first month's storage) of the cost of unloading and loading cars, transfers from wharves to warehouses, cartage, weighing and other services has been a growing evil. It has in effect given

indirect rebates to certain customers and appreciably added to the losses of the warehouseman. It has been proved that in some instances the cost of handling and other services absorbed have made it impossible to earn one cent from certain lots of merchandise until they had been in store four months or more.

The simplest handling operation is the receiving of goods from the tailboard of a truck, the hoisting and piling in warehouse and the redelivery to the tailboard of a truck (other services being sometimes required and sometimes not); it is therefore good accounting to make this the base operation charged for in the first month and make extra charges for extra services. Thus, car loading and unloading should be charged for separately, as well as cartage, weighing or any other service required, each being placed on productive cost plus overhead, plus profit.

In these days of advancing wages, cost figures at the time goods are received may be based on a wage scale far lower than when the goods are delivered. The present method of billing for receiving and delivering allows no opportunity of taking care of this possible source of loss. The proper method of handling this phase of the subject would be to charge handling *out* to the party owning the goods when delivery is made. This is such a radical change that it is not deemed advisable to make such recommendation at this time.

It is very essential that much data be secured in all parts of the country as to the productive labor cost of handling all kinds of merchandise. Productive labor as used in this report is understood to mean the wage cost of the laborers and checkers while actually employed on an operation for which the warehouse is making a charge.

In order to make these records valuable in all sections of the country they should be computed on a man-hour basis, counting the checker as one and one-quarter times the cost of a laborer. By the use of man-hours real comparison may be made and results may be easily translated into dollars and cents by applying the wage per hour prevailing in any particular locality.

UNIFORM COST ACCOUNTING

From the same report is quoted the following on uniform cost accounting:

Uniform systems of accounts and statistical records form the bed rock upon which any rate foundation or structure must be built if the building is to stand the tests which are bound to be applied either by customers or by public officials, and this is as pertinent to warehousing as it is to transportation or any other form of public utility.

In calculating rates, statistical data must be available from many warehouses in order that averages may be obtained upon which to establish standards. Uniform systems of keeping the accounts and statistics by the warehouses will be necessary in order to substantiate any rates made for storage, handling, car loading and unloading or any other service rendered.

A suitable system of uniform accounting will necessitate:

I. CLASSIFICATION OF EARNINGS OR RECEIPTS

Uniform classification with separate accounts for these earnings for all important sources:

(a) Storage
(b) Handling (receiving and delivering sill to sill)
(c) Weighing and sampling
(d) Miscellaneous extra service
(e) Loading and unloading cars
(f) All other miscellaneous sources of revenue

II. CLASSIFICATION OF EXPENSES

Uniform classification of expense of operating, with separate accounts subdivided as in earnings:

(a) Storage
(b) Handling (corresponding to b, c and d, under earnings)
(e) Car service
(f) Expenses connected with miscellaneous sources of revenue

III. DETERMINATION OF INVESTMENT

(a) Plant
  Land
  Buildings
  Private street
(b) Equipment
  Elevators
  Trucks, etc.
(c) Trackage facilities
  Land
  Car tracks
  Car platforms

IV. DETERMINATION AND APPLICATION OF OVERHEAD EXPENSES

All payroll items and other expenses which cannot be applied directly to storage, handling, car service or any other particular service must be analyzed and distributed according to a uniform plan. These being added to the direct costs, the entire or true cost of each service will be found.

CLASSIFICATION OF EXPENSES IN DETAIL

EXPENSE (A) STORAGE

The storage expenses include the following items:

Rent, or in Lieu of Rent.

1. Seven per cent on investment including buildings, land occupied by buildings and interest, taxes and insurance during construction.
2. Depreciation — 2 per cent on value of brick or concrete buildings and 3 per cent on frame buildings.
3. Obsolescence.
4. Fire insurance on buildings.
5. Taxes, Federal, State and municipal, applicable to real estate.
6. Repairs to building.
7. Landlord's risk, amortization and profit on investment.

Administration and Operating Expenses, Taxes, Etc.

1. One-third of executives' salaries, salaries of departmental heads, office salaries, general office and miscellaneous expense.
2. Watching.
3. Advertising.
4. Interest on working capital.
5. Taxes. Applicable to storage.
6. Contingencies.

Explanatory Notes (Expense (A) Storage)

Investment.

If the plant is rented, estimated values should be used.

Depreciation.

Depreciation as usually allowed by the Internal Revenue Department is 2 per cent on brick or concrete buildings and 3 per cent on frame buildings.

Obsolescence.

Obsolescence as allowed by the Internal Revenue Department should be given due consideration.

Repairs.

This item comprises only ordinary repairs to keep buildings in good condition. Extraordinary repairs increasing the value of the plant should go to capital or investment accounts.

General Expenses.

An analysis of a number of warehouses shows that about two-thirds of the time of the office employees, and therefore the management also, is concerned with the various handling operations. Storage is rental and can be carried on by a very small force if a contractor or some other party attends to the handling. Office expenses, such as telephones, office coal and light, and sundry expenses are also included in this item.

Watching.

Watching is for the protection of the property and reduces the fire insurance rate. It, therefore, is a proper storage expense.

Advertising.

Advertising for storage only belongs here. The warehouseman's principal business is that of storage, and handling is incidental to it; accordingly it is proper to consider advertising for storage purely a storage expense. Advertising for laborers is a labor expense.

Interest on Working Capital.

A certain amount of working capital is necessary to carry bills receivable.

EXPENSE (B) HANDLING — (C) WEIGHING AND SAMPLING — (D) MISCELLANEOUS EXTRA SERVICE

1. Actual warehouse labor employed productively, including warehouse clerks, checkers and weighers.
2. Non-productive labor, including:
   Moving merchandise.
   Holiday time.
   Janitor and cleaning.
   Undistributed labor.
3. Liability insurance.
4. Seven per cent on the investment in equipment, including elevators, whips, trucks, scales, etc.
5. Taxes applicable to handling whether assessed on value of equipment, amount of working capital or on income.
6. Ten per cent depreciation on Item 4.
7. Repairs to equipment.
8. Power and light.
9. Claims.
10. Two-thirds of executives' salaries, salaries of departmental heads, office salaries, general office and miscellaneous expense. (Less amount charged to car service.)
11. Interest on working capital.
12. Miscellaneous supplies and expenses connected with labor.

NOTE A.— Items 2 to 12, inclusive, divided by Item 1 will produce the percentage of overhead expense for handling.

NOTE B.— Item 10 includes:

Executive salaries
Salaries of departmental heads
Office salaries
Office supplies
Telephone
Water
Coal for office heating
Contributions

and all miscellaneous small items of expense not directly chargeable to Storage, Handling, Car Service or other miscellaneous services.

Explanatory Notes

Productive and Non-Productive Labor.

The method of finding these amounts by divisions of the payroll is discussed in the section devoted to this subject.

Equipment Investment.

The investment in equipment should be determined by the warehouseman to furnish a basis for these figures.

Power and Light.

Furnishing of power or light is a labor service, varying according to the amount of merchandise handled, storage as such not requiring either. They are therefore handling expenses.

(Storage should be kept a simple space rental proposition.)

Claims.

This refers to breakage and loss claims due to negligence in handling merchandise. There are some claims which might be considered as storage liability, such as damage from leaking roofs. Each claim should be analyzed and placed where it belongs.

Portion of General Expenses.

Where the labor covers more than one service, it is defensible to distribute the overhead expense proportionally according to the percentage the gross billing for each service bears to the total gross billing for labor.

Miscellaneous Expense.

This covers items of general expense, directly chargeable to labor.

Lubricants for equipment, general care of equipment and employment departments are some items which are included.

EXPENSE (E) CAR SERVICE

1. Actual labor loading and unloading cars.
2. Non-productive labor.
3. Liability insurance.
4. Seven per cent on investment in land, tracks and platforms.
5. Taxes applicable to Car Service.
6. Five per cent depreciation on investment in tracks, etc.
7. Repairs to tracks, etc.
8. A share of executives' salaries, salaries of departmental heads, office salaries and general office and miscellaneous expenses.
9. Interest on working capital.
10. Contingencies.

NOTE.— Item 8 should be determined as follows: Find the percentage relation which the billings for loading and unloading cars bear to the total billings, exclusive of storage. Credit the amount represented by this percentage to Item 10, Expense (B) Handling, (C) Weighing and Sampling, (D) Miscellaneous Extra Services, and charge a like amount to Item 8 under Expense (E) Car Service.

The American Warehousemen's Association has established a central bureau, referred to elsewhere in this work, which is prepared to furnish warehousemen specimen forms and information concerning methods of keeping cost figures. The primer furnished by the American Warehousemen's Association outlines a simple method of cost finding.

PAYROLL DIVISION

In order that the warehouseman may determine his costs according to the method proposed it becomes necessary to distribute the payroll. The foundation of this is the use of daily time cards, either in the hands of individual laborers or gang foreman, giving the time of the man or men, information as to the lot of goods handled and the different services performed. To be of real value this must be carefully carried on with competent supervision and made to balance with the payroll. A portion of the results will be productive labor costs and the balance non-productive items such as idle time, cleaning, moving merchandise to make room, etc.

DETERMINATION OF OVERHEAD

Next must be ascertained the overhead expense which applies to handling and other services. This is done by adding to the non-productive labor the liability insurance, interest, depreciation, taxes, repairs to equipment and other items as shown in the classification of Expense B, C, D and E.

COST DEPARTMENT

We recommend that each warehouseman if he has not already done so, organize a cost department headed by a man who combines good accounting ability with a practical warehouse experience, furnishing him with as much assistance as is necessary to keep the work up to date at all times.

AN EQUITABLE PROFIT IN EACH DEPARTMENT

Every department of the warehouseman's plant should show a profit at the end of the year. No service should be rendered without profit. All profit should be reasonable.

No department should perform a service free or below cost to attract storage business, for indirect rebate is thereby given which will injure the business far more than the few dollars received for the storage gained.

This ideal condition it is safe to say has not heretofore existed in the warehouse industry.

CONCLUSION

The above system of cost accounting and basis for tariffs, if carried out intelligently, will give the warehouseman the following knowledge:

Income, cost and profit of maintaining and operating each unit of warehouse space.

Income, cost and profit of handling each lot of merchandise from sill to sill.

Income, cost and profit of loading and unloading cars.

Income, cost and profit of weighing, sampling or any other service for which separate charges are made to the customer.

These fundamental facts will be of untold assistance in quoting and defending prices and setting a new and higher standard for the entire industry. A warehouseman will then have no hesitation in quoting rates to his customers because he will have that secure feeling that his rates are based upon proven costs with a legitimate profit added.

Charges are also made for car demurrage, distribution (checking out and delivery at car or warehouse door of goods not stored), drayage (when delivery is required in inconvenient places), shipping (billing, marking, tagging, procuring bills of lading and mailing same), dunnage, light, power or tools loaned to customer, taking down or replacing goods in store for weighing or other convenience for delivery of small packages, revenue stamps, extra postage and negotiable receipts.

Warehouse Revenues and Costs

From the warehouse studies some idea of the revenues and handling costs in and out of warehouses was obtained. Table 14 gives approximate revenues per square foot for the years 1915 to 1919, inclusive. Table

TABLE 14 — TYPICAL REVENUES IN CENTS PER SQUARE FOOT FOR WAREHOUSE SPACE, 1915–1918, EXCLUSIVE OF HANDLING CHARGES AND OTHER INCIDENTAL REVENUES

	1915	1916	1917	1918
Revenue per year per square foot of gross floor area	19	22	38	45
Revenue per year per square foot of available floor space	23	27	46	55
Revenue per year per square foot of occupied floor space	32	38	52	59

TABLE 15 — TYPICAL PRODUCTIVE LABOR COST OF HANDLING FROM SILL TO SILL VARIOUS COMMODITIES IN AND OUT OF WAREHOUSES IN 1919 — LABOR AND CHECKERS ONLY

Commodity	Kind of package	Weight of package, lb.	Receiving from sill of warehouse, cents per 100 lb.	Delivering to sill of warehouse, cents per 100 lb.	Total in and out, cents per 100 lb.
Beans	Bags	100	1.64	1.28	2.92
Cocoa	Bags	180	1.66	1.04	2.70
Cocoa	Bags	200	1.30	1.27	2.57
Coffee	Bags	132	2.21	1.31	3.52
Coffee	Bags	154	2.06	1.26	3.32
Cotton	Bales	550	1.78	1.34	3.12
Merchandise	Bags	150	2.02	1.41	3.43
Merchandise	Bags	250	1.33	0.99	2.32
Merchandise	Barrels	150	1.77	1.93	3.70
Merchandise	Cases	75	1.59	1.11	2.70
Loose hides		32½	2.98	2.31	5.29
Hides	Bales	250	.87	0.94	1.81
Rubber	Cases	375	1.90	1.80	3.70
Tea	Chests	150	3.50	1.49	4.99
Tobacco	Seroons	110	3.98	2.75	6.73
Wool	Bales	450	1.70	1.66	3.36

15 gives approximate productive labor costs as of 1919 on many commodities in and out of warehouses.

Classes of Warehouses

There are eight principal classes of warehouses, distinguished by their principal use for or by

(1) ship's cargo,
(2) railroads,
(3) draymen,
(4) manufacturers,
(5) middlemen,
(6) retailers,
(7) market purposes, and
(8) storage of household goods.

Access by water, rail and street are desirable for all except Classes 3 and 8 and economically necessary for some.

WAREHOUSES FOR SHIP'S CARGO

Warehouses for ship's cargo more than any of the others require the three means of access. Because a large percentage of inbound cargo finds its way to such a warehouse, and in order to avoid unnecessary drayage and rehandling of freight, a location on commercial waterfront contiguous or nearly so to the quays or piers serving ships and lighters should be chosen and rail and street should come to it. A location where rail or team access can not be had should be avoided.

The warehouse may be located on the piers or on the adjacent uplands as conditions dictate, but lines of traffic should be carefully studied in the planning so that train and dray movements to and from the warehouse and the movement of goods between warehouse and ship do not conflict with each other or with direct movements of trains and drays to and from the ship.

WAREHOUSES FOR USE BY RAILROADS

Railroad usage of warehouses is twofold. Ten days' free storage is allowed on export freight and two days on other lighterage freight. If in carload lots it is held in cars, if in less-than-carload lots it is held in cars or in warehouses at the railroad company's option. The warehouse used for less-than-carload lots is usually the lighterage pier at the waterfront yard of the railroad.

Two days' free storage is allowed at railroad freight stations to the general public. If freight is not removed from the station within this period it is sent to a public warehouse or storage is charged for at the freight station. Usually the freight goes to a public warehouse.

At the lighterage pier rail and water access are vital and dray access is desirable but not usually available. At the freight station rail and dray access are vital for inland stations and water and dray access for pier stations.

The use of and therefore the number of lighterage piers could be minimized if every steamship pier had proper warehouse and track facilities.

WAREHOUSES FOR USE BY DRAYMEN

Warehouses for use by draymen are hardly warehouses. The drayman may maintain a building if engaged in a "pick-up and delivery" business, but the building is rather an assembling and consolidating station than a warehouse. Street access is the only vital access.

WAREHOUSES FOR USE BY MANUFACTURERS

The manufacturer usually requires a warehouse for storing raw materials before or finished materials after manufacturing. All three modes of access are desirable, but other considerations may decide against one or two of them, and the location is usually adjacent either to the factory or to a shipping point.

WAREHOUSES FOR MIDDLEMEN

The middleman's warehouse is a storage reservoir between the producer and the consumer. The warehouse location is one that must be decided by the exigencies of the business. The warehouse of this class is distinctly related to that of Class 7 and all three modes of access are desirable. Street access is the most essential.

WAREHOUSES FOR RETAILERS

The retailer whose volume of business is such that sales of larger articles are virtually made from sample requires a warehouse to store the goods the purchaser actually receives. All three means of access are desirable, but truck and rail access are predominant and the warehouse should be so located as to minimize truck haul.

WAREHOUSES FOR MARKET PURPOSES

Warehouses for market purposes serve the producer, the middleman and the retailer, but their use is mainly for articles of food requiring cold storage. They are necessary at various locations, at the point of collection from the producer, at the railheads at the journey's end and in the immediate vicinity of the market centers. Rail, water and truck access are all desirable.

Cold-storage warehouses have with perhaps some reason been much abused as an instrument for maintaining high food prices, and there is a general distaste for cold-storage foodstuffs other than dressed meats. To abolish cold storage would, however, raise the cost of living. To establish laws regulating arbitrarily the length of cold storage seems inadvisable.

The lack of continuous refrigeration from producer to consumer is responsible for an enormous wastage and is responsible for the general dislike of cold-storage food. Everybody likes Western beef. Why? Because it more nearly than any other refrigerated product has continuous refrigeration. Eggs have not; butter has not; poultry has not. It might be better to provide for such continuous refrigeration by law than to attempt to prescribe specific lengths of storage.

Much interesting information regarding cold-storage warehousing is contained in the Report of the Mayor's Market Commission of New York City published in December, 1913, and in pamphlets of the United States Department of Agriculture. The subject is too broad to cover in this chapter.

WAREHOUSES FOR HOUSEHOLD GOODS

Warehouses for household goods need truck access more than either of the other two modes because moving is mainly intracommunity rather than intercommunity, and the exceptions can be cared for by trucking from warehouse to freight station or even to lighter.

CHAPTER 19

Ferries and Vehicular Tunnels

Ferries have long constituted an important element in the transportation system of the Port of New York. In the East River they have been largely replaced by bridges and tunnels, but they are as yet the only means of transferring vehicles across the Hudson River and across the Upper Bay to and from Staten Island, while they are also the sole dependence of three of the New Jersey railroads for getting passengers to and from their trains. Furthermore, one of the plans considered by the Commission called for a greatly extended use of the ferries, and it became necessary to know precisely both what service they now perform and what further service they could perform. Clockings were therefore made of all except a few of the least important ferries of the Port, similar in their general aspects to the railroad and steamship clockings. The Commission's conclusion, based on these clockings and on its general study of the situation, is that no radical change in the ferry system is called for. It recommends only that the lower cabins of some of the boats of heavy vehicular and comparatively light passenger traffic be removed; and that where possible more boats be run during hours of peak vehicular traffic.

Table 1 — Ferry Lines to and from Manhattan

Owner	Manhattan terminus	Other terminus	Number of Manhattan slips
	New Jersey (Hudson River) Lines		
Central Railroad of New Jersey	Liberty street	Jersey City terminal	2
	Twenty-third street	Jersey City terminal	1
Pennsylvania railroad	Cortlandt street	Jersey City terminal	2
	Desbrosses street	Jersey City terminal	2
Erie railroad	Chambers street	Jersey City terminal	2
	Twenty-third street	Jersey City terminal	2
Lackawanna railroad	Barclay street	Hoboken terminal	2
	Christopher street	Hoboken terminal	2
	Twenty-third street	Hoboken terminal	2
	Twenty-third street	Fourteenth street, Hoboken	1
West Shore railroad	Cortlandt street	Weehawken terminal	1
	Forty-second street	Weehawken terminal	2
	Forty-second street	West New York	1
Riverside & Fort Lee Ferry Company	Manhattan (130th) street	Edgewater	2
Dyckman St. & Englewood Ferry Company	Dyckman (200th) street	Palisades Interstate Park	2
	Long Island (East River) Lines		
City of New York	Whitehall street	Thirty-ninth street, Brooklyn	2
Union Ferry Company	Whitehall street	Hamilton avenue, Brooklyn	1
	Whitehall street	Atlantic avenue, Brooklyn	1
	Fulton street	Fulton street, Brooklyn	1
Tenth & Twenty-third St. Ferry Corp	Twenty-third street	Greenpoint, Brooklyn	2
Long Island railroad	Thirty-fourth street	Long Island City terminal	1
	Staten Island Line		
City of New York	Whitehall street	St. George, Staten Island	2

The States of New York and New Jersey have recently begun the construction of a vehicular tunnel under the Hudson River between New York City and Jersey City, under the direction of the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission. Reports of those commissions dated February 10, 1920, and March 7, 1920, respectively, present information as to the character and volume of traffic expected. The Commission has not therefore deemed it necessary to go into this subject, except as to the possibility of vehicular tunnels rendering the ferries unnecessary. Its views on that point are set forth at the end of this chapter.

Existing Ferries

Table 1 lists the twenty-two ferries clocked, which include all of the most important ones in present operation — all that run to and from Manhattan. The only other ferries within the Port District are four from different points in Staten Island to New Jersey and one across the Narrows from Staten Island to South Brooklyn.

All of the thirteen ferries in the Hudson River to and from lower Manhattan are owned by the railroads, and all but two were established to serve their passenger terminals before the Hudson & Manhattan and the Pennsylvania tunnels provided any other means for passengers to get across the river. The two exceptions reach other points on the New Jersey waterfront and escape the heavy passenger traffic of suburban residents using the railroads, but one of them nevertheless carries a large local passenger traffic as well as a large number of trucks and wagons. The Pennsylvania ferries have a comparatively light passenger traffic because only a few passenger trains now use the Jersey City Terminal.

These ferries represent a high order of ferry development. Most of the boats are large, double-decked, screw-propelled vessels, with side cabins on the lower decks and the entire upper decks given over to passengers. Growth of New Jersey suburban travel has neutralized the effect of the Hudson & Manhattan tunnels, which reach the Erie and the Lackawanna but not the West Shore or the Central of New Jersey, and the ferries carry a heavy passenger traffic. Some of the busiest lines operate during the morning and evening rush hours on as short as a 7½ min. headway and carry from 1000 to 2000 passengers per trip. The ferry schedules are arranged to handle the peak passenger loads.

The Edgewater ferry, connecting with the North Jersey Street Railway Company and so serving a number of growing communities on the Palisades, and also reaching the numerous large waterfront industries in that vicinity, has a heavy traffic. The Dyckman Street traffic consists mainly of pleasure automobiles and visitors to the Palisades Interstate Park.

Fifteen years ago there were nearly as many ferry lines on the East River as on the Hudson River. The completion of the second (Williamsburg) bridge over the East River in 1904 and of the first of the rapid-transit tunnels a little later cut the traffic down materially, and as other bridges and tunnels have been completed most of the lines have been discontinued. With the exception of the boats of the Long Island Railroad, which are comparable with some of the Hudson River railroad ferries, and the city-owned South Brooklyn ferry, those now operating on the East River, like those taken off, are small, single-decked vessels with sidewheels. Little advance has been made in their construction for many years.

The city-owned boats running from Whitehall Street (South Ferry) to Thirty-ninth Street, Brooklyn, and to Staten Island represent the highest development in point of size in the harbor. They are screw-propelled and doubled-decked. The Staten Island boats are the largest, and carry as many as 3000 passengers per trip in addition to twenty-eight vehicles, but three of the Thirty-ninth Street boats, with their lower-deck cabins removed and the entire deck given over to vehicles, of which fifty have been carried on one trip, still have room on the upper deck for 1500 passengers.

CLOCKINGS OF FERRIES

Twenty-four-hour clockings were made of all of the ferry lines listed in Table 1 (with the exception of the Greenpoint ferry, whose management supplied the Commission with partial records) during the period from July 30 to September 9, 1919. Inspectors stationed at the Manhattan ferry houses recorded on blanks provided for the purpose the following information:

Name and time of each boat arriving and each boat departing.
Number of loaded service vehicles on each boat, subdivided into one-horse wagons or trucks, two-horse trucks, light motor trucks and heavy motor trucks.
Number of empty vehicles, subdivided in the same manner.
Number of passenger vehicles.
Number of passengers.

Counts of vehicular traffic were made at the ferry-house driveways.

Counts of outbound passengers were made at the ticket boxes. As inbound passengers from the railroads do not have to present tickets, they could not be counted in that way, so they were estimated in groups of ten at the ferry bridges and other established points, and the groups checked off on tally sheets.

The first of the clockings were made by a force consisting of a squad leader and four inspectors. Later this force was increased by two men, and to cover some of the heaviest operations the party was further augmented by men from the office staff.

Data as to the number, names and capacities of the boats of each line in commission and out of commission for repairs or other reasons were obtained from the various officials, as were the operating schedules.

Statistics of Ferry Operations

From the standpoint of the port problem, the most important ferries are the railroad group on the Hudson River and the municipal ferry from Manhattan to Staten Island. Some of the others carry a fairly heavy traffic, but none, with the exception of the two upper Hudson ferries, are the sole means of vehicular intercommunication.

HUDSON RIVER RAILROAD FERRIES

Fifty ferryboats are employed in the operation of these thirteen railroad ferries, including a certain percentage in reserve or undergoing repairs. The most important lines require four and five boats during the peaks of the day. The least important operate with only one or two boats.

The Central Railroad of New Jersey, operating two ferries, has ten boats, all double-decked, screw-propelled and of about the same size. They have a rated capacity of 14 vehicles and 1700 passengers each. Five boats are required by the week-day schedule of the Liberty Street line to accommodate the heavy passenger traffic, and three by that of the Twenty-third Street line, leaving two in reserve.

The Pennsylvania, operating the two ferries of heaviest vehicular traffic in the harbor, has eight boats, all double-decked and screw-propelled. Originally all eight were of about the same capacity, 14 vehicles and 1800 passengers. Because of the heavy truck traffic and the light passenger traffic, the lower-deck cabins of six of the eight boats have been removed, doubling the vehicular capacity while reducing the passenger capacity to 1000. Three boats on each line handle the traffic, leaving a fourth in reserve for each.

The Erie, operating two ferries, has nine boats. Five are double-decked and screw-propelled, with rated capacities of 17 vehicles and 2000 passengers. The remaining four are single-decked sidewheel vessels, with capacities for 15 vehicles and 800 passengers each. The smaller boats run mainly on the Twenty-third Street line. The week-day schedules require four boats on the Chambers Street line and three on the Twenty-third Street line, leaving one boat in reserve for each.

The Lackawanna, operating four ferries, has 14 boats. They are of several types. Four, operating ordinarily on the Barclay Street line, are double-decked and screw-propelled, with rated capacities of 14 vehicles and 2000 passengers each. Eight, used primarily on the Christopher and Twenty-third Street lines, are somewhat smaller, with rated passenger capacities of 1700 each. Six of these have screw propellers; two have sidewheels. The two remaining boats of the fleet are single-decked sidewheelers, with capacities of 900 passengers each. They run on the Fourteenth Street, Hoboken, line. The vehicular capacities of all 14 boats are rated the same.

The week-day schedules require four boats for the

Barclay Street line, three each for Christopher Street and Twenty-third Street, and two for Fourteenth Street, Hoboken. There are therefore two reserve boats.

The West Shore, with three ferries, has nine boats. Most of these are double-decked and screw-propelled, with approximate capacities of 15 vehicles and 1700 passengers each. The remaining ones are single-decked sidewheelers, able to carry about 15 vehicles and 900 passengers each. Four boats are required for the week-day schedule of the Cortlandt Street line and three for that of the Forty-second Street-Weehawken line, while a single boat suffices for the West New York line, leaving one boat in reserve.

The ferry runs of the thirteen railroad lines range in length from less than a mile in the case of those that are nearly straight across the river to three or four miles in the case of one or two. The average length in terms of total trips made probably does not exceed 1½ miles, as the shortest lines are in the main the most important.

As the ferry schedules are in general made to conform with train schedules and passenger travel, the maximum number of boats operated and trips made (see Table 4) occur in the morning and evening rush hours. The schedules conform fairly but not extremely closely with the vehicular requirements. While the maximum number of trips inbound to Manhattan is from 8 to 9 A. M. and from 5 to 6 P. M., the maximum number of vehicles according to the clockings is from 10 to 11 A. M.; and while the maximum number of trips outbound is from 8 to 9 A. M. and from 6 to 7 P. M., the maximum number of vehicles is from 4 to 5 P. M. The result is that the trucking capacities are more nearly reached at the truck peak hours than at any other times. An approach to the same degree of saturation inbound is made between 2 and 4 A. M., when a rather heavy vehicular traffic has to be accommodated on a minimum number of boats. It is apparent, however, that as many boats can be operated in these off hours as the traffic warrants.

Tables 2, 3 and 4 summarize the information obtained in the clockings of the Hudson River railroad ferries. The lack of complete harmony between the peak service and the peak vehicular traffic is reflected in the high percentages of space occupied during those hours of peak vehicular traffic.

Some of the lines, as Tables 2 and 3 show, carry few pleasure vehicles. On others the pleasure vehicles on the days of the clockings constituted some 15 to 50 per cent of the total number of vehicles carried. The heavily burdened Pennsylvania ferries carried a large number of such vehicles, and the Forty-second Street-Weehawken ferry, which is the main route for through automobile travel, carried more pleasure vehicles both ways than service vehicles.

Of the service vehicles a large percentage were empty, the "empties" actually exceeding the "loads" outbound on one of the lines. More than a third of the service vehicles carried collectively by the thirteen lines were empty. Evidently present methods, requiring the transportation of so much empty equipment, are wasteful.

TABLE 2 — ONE-DAY TRAFFIC BY INDIVIDUAL LINES OF HUDSON RIVER RAILROAD FERRIES AS DEVELOPED BY CLOCKINGS

	Inbound						Outbound					
FERRY	Loaded service vehicles	Empty service vehicles	Total service vehicles	Pleasure vehicles	Total vehicles	Passengers	Loaded service vehicles	Empty service vehicles	Total service vehicles	Pleasure vehicles	Total vehicles	Passengers
C. of N. J.												
Liberty st	760	161	921	21	942	21,035	318	522	840	17	857	20,768
23d st	230	101	331	10	341	1,745	233	117	350	26	376	1,677
Total	990	262	1,252	31	1,283	22,780	551	639	1,190	43	1,233	22,445
Pennsylvania												
Cortlandt st	719	377	1,096	307	1,403	4,585	701	478	1,179	331	1,510	4,986
Desbrosses st	1,060	527	1,587	275	1,862	3,392	1,031	477	1,508	271	1,779	3.162
Total	1,779	904	2,683	582	3,265	7,977	1,732	955	2,687	602	3,289	8,148
Erie												
Chambers st	447	283	730	18	748	18,872	506	293	799	31	830	18,271
23d st	256	158	414	22	436	2,591	318	129	447	44	491	2,585
Total	703	441	1,144	40	1,184	21,463	824	422	1,246	75	1,321	20,856
Lackawanna												
Barclay st	452	414	866	171	1,037	20,446	651	273	924	166	1,090	21,618
Christopher st	395	311	706	113	819	8,573	498	256	754	92	846	8,662
23d st	496	254	750	301	1,051	7,054	472	243	715	329	1,044	7,069
14th st., Hoboken	458	314	772	334	1,133	8,642	470	212	682	374	1,056	9,102
Total	1,831	1,293	3,124	949	4,073	44,715	2,031	1,014	3,075	961	4,036	46,451
West Shore												
Cortlandt st	177	122	299	83	382	8,372	235	75	310	71	381	8,390
42d st.-Weehawken	494	215	709	720	1,429	21,530	510	163	673	736	1,409	21,464
42d st.-West New York	46	27	73	17	90	684	37	17	54	5	59	632
Total	717	364	1,081	820	1,901	30,586	782	255	1,037	812	1,849	30,486
Grand total	6,020	3,234	9,234	2,422	11,706	127,521	5,950	3,235	9,235	2,493	11,728	128,386

STATEN ISLAND FERRY

As the only means of transit for persons and vehicles between Manhattan and Staten Island, if we disregard the roundabout ferry route across the Narrows and the more roundabout routes through New Jersey, the Staten Island ferry is second in importance to the New Jersey railroad group and is more vital than any single line of that group. Suspension of service on it for one day during one of the strikes of last year caused a very serious derangement of the daily routine of the borough.

There are five vessels designed primarily for the Staten Island line. As the City of New York also operates the Thirty-ninth Street, Brooklyn, line, its boats are used more or less interchangeably with those of the Staten Island line. In all the city has nine vessels, double-decked and screw-propelled, the largest ferryboats in the harbor. The five built for the Staten Island heavy

TABLE 3 — TOTAL NUMBER OF VEHICLES AND PASSENGERS CARRIED EACH HOUR OF TEST DAY, ALL HUDSON RIVER RAILROAD FERRIES

Hour	Inbound						Outbound					
	Loaded service vehicles	Empty service vehicles	Total service vehicles	Pleasure vehicles	Total vehicles	Passengers	Loaded service vehicles	Empty service vehicles	Total service vehicles	Pleasure vehicles	Total vehicles	Passengers
A. M.												
12–1	176	27	203	50	253	899	64	81	145	48	193	1,093
1–2	209	27	236	13	249	268	95	33	128	33	161	375
2–3	232	49	281	15	296	149	120	77	197	23	220	321
3–4	221	51	272	10	282	163	59	68	127	12	139	261
4–5	200	43	243	10	253	319	47	59	106	5	111	143
5–6	183	51	234	9	243	731	68	31	99	4	103	771
6–7	221	165	386	18	404	5,366	159	73	232	20	252	7,119
7–8	294	218	512	53	565	18,151	276	156	432	33	465	6,712
8–9	378	247	625	88	713	35,304	415	226	641	54	695	3,201
9–10	480	169	649	138	787	12,787	475	234	709	89	798	2,478
10–11	499	228	727	111	838	5,760	414	235	649	140	789	2,879
11–12	441	200	641	168	809	3,421	385	216	601	149	750	3,062
P. M.												
12–1	426	188	614	171	785	3,700	320	194	514	146	660	4,310
1–2	395	214	609	197	806	4,564	345	211	556	141	697	3,791
2–3	348	215	563	165	728	3,679	379	202	581	159	740	4,136
3–4	346	230	576	212	788	3,529	406	218	624	184	808	5,542
4–5	259	241	500	193	693	5,306	405	227	632	251	883	11,315
5–6	164	204	368	231	599	7,871	354	234	588	281	869	39,821
6–7	96	146	242	158	400	5,349	378	172	550	244	794	15,006
7–8	79	135	214	127	341	2,990	234	60	294	122	416	5,271
8–9	109	78	187	119	306	2,587	205	42	247	100	347	3,639
9–10	82	55	137	53	190	1,607	157	40	197	84	281	2,760
10–11	75	51	126	61	187	1,915	81	51	132	77	209	2,111
11–12	107	32	139	52	191	1,106	109	145	254	94	348	2,269
Total	6,020	3,264	9,284	2,422	11,706	127,521	5,950	3,285	9,235	2,493	11,728	128,386

TABLE 4 — RELATION OF VEHICULAR TRAFFIC TO CAPACITY, HOUR BY HOUR, ON HUDSON RIVER RAILROAD FERRIES

Hour	Boats operating		Total number of trips		Vehicles carried		Vehicular capacity per hour		Percentage of space occupied		Percentage of space not occupied	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
A. M.												
12–1	14	14	24	25	253	193	465	479	54	40	46	60
1–2	10	12	22	22	249	168	431	418	58	40	42	60
2–3	10	11	22	22	296	220	416	430	71	51	29	49
3–4	10	11	20	19	282	139	370	338	76	41	24	59
4–5	11	12	21	20	253	111	394	373	64	30	36	70
5–6	16	20	27	29	243	103	480	531	51	19	49	81
6–7	28	29	46	46	404	252	846	844	48	30	52	70
7–8	38	37	59	60	565	465	1,051	1,080	54	43	46	57
8–9	38	38	64	65	713	695	1,142	1,156	62	60	38	40
9–10	39	39	62	61	787	798	1,095	1,095	72	73	28	27
10–11	37	37	60	60	838	789	1,063	1,072	79	73	21	27
11–12	34	34	54	55	809	750	974	963	83	78	17	22
P. M.												
12–1	34	34	58	58	785	660	1,034	1,045	76	63	24	37
1–2	33	34	59	57	806	697	1,066	1,029	76	68	24	32
2–3	34	34	54	56	728	740	987	1,015	75	73	25	27
3–4	37	35	57	57	788	808	1,016	1,030	58	78	42	21
4–5	38	37	64	63	693	883	1,152	1,141	60	77	40	22
5–6	38	38	65	64	599	869	1,170	1,142	51	76	49	23
6–7	37	37	64	66	400	794	1,166	1,205	34	65	66	35
7–8	35	35	58	56	341	416	1,030	1,008	33	42	67	58
8–9	32	32	56	53	306	347	1,031	964	30	36	70	64
9–10	26	28	41	53	190	281	764	802	25	35	75	65
10–11	17	18	31	26	187	209	619	510	30	41	70	59
11–12	16	16	23	28	191	348	415	521	46	65	54	35
Total	43	43	1,111	1,111	11,706	11,728	20,177	20,191				
Average									58	58	42	42

passenger traffic have capacities of 28 vehicles and 3500 passengers each. Three designed for the much smaller passenger traffic to and from Thirty-ninth Street, Brooklyn, have had the lower cabins removed and will carry 50 vehicles and 1500 passengers each. The remaining boat of the nine will carry 18 vehicles and 2000 passengers. The length of the run is about four miles.

Five boats will carry out the week-day schedule of the Staten Island line, and two will take care of the Thirty-ninth Street line, leaving two boats in reserve.

Table 5 shows the one-day traffic on the Staten Island line, together with that of the individual lines on the East River and the two upper Hudson lines. It indicates that the Staten Island line carries a large vehicular traffic, though not as large as several of the Hudson River railroads carry; that somewhat more than a third of this traffic consists of pleasure vehicles; and that of the service vehicles, a goodly percentage are empty. It also shows that the line carries a very large passenger traffic, nearly double that of the busiest Hudson River railroad ferry.

Table 6 is of the same form as Table 3 pertaining to the Hudson River railroad ferries. Like Table 3, it shows a large concentration of passenger traffic inbound in the morning rush hours and outbound in the evening rush hours. The peaks are less pronounced, however, partly because there is a considerable rush-hour movement in the opposite directions, caused by workers in Staten Island resident elsewhere, and partly because there is a larger distribution of passengers throughout the day.

The table shows a much larger percentage of pleasure vehicular traffic on the day of the clocking than the

TABLE 5 — ONE-DAY TRAFFIC BY INDIVIDUAL LINES OF STATEN ISLAND, BROOKLYN, LONG ISLAND CITY AND UPPER HUDSON FERRIES

FERRY	Inbound						Outbound					
	Loaded service vehicles	Empty service vehicles	Total service vehicles	Pleasure vehicles	Total vehicles	Passengers	Loaded service vehicles	Empty service vehicles	Total service vehicles	Pleasure vehicles	Total vehicles	Passengers
St. George, Staten Island	445	243	688	361	1,049	34,471	501	113	614	379	993	34,460
39th st., Brooklyn	394	112	506	8	514	2,799	223	266	489	10	499	1,832
Hamilton ave., Brooklyn	303	319	622	16	638	8,704	498	176	674	16	690	9,688
Atlantic ave., Brooklyn	126	114	240	7	247	2,049	223	52	275	7	282	1,970
Fulton st., Brooklyn	212	82	294	2	296	684	268	70	338	3	341	685
Greenpoint, Brooklyn		No details			503	4,071		No details			446	4,343
Long Island railroad	413	171	584	5	589	1,989	331	190	521	4	525	2,070
Edgewater	181	152	333	866	1,199	15,259	216	110	326	828	1,154	15.798
Dyckman st	*239	19	258	325	583	1,307	23	8	31	351	382	313
Total	†2,313	†1,212	†3,525	†1,590	5,618	71,333	†2,283	†985	†3,268	†1,598	5,312	71,159

* All army equipment except 21 motor trucks.
† Exclusive of Greenpoint ferry figures.

TABLE 6 — TOTAL NUMBER OF VEHICLES AND PASSENGERS CARRIED EACH HOUR OF TEST DAY, STATEN ISLAND FERRY

HOUR	Inbound						Outbound					
	Loaded service vehicles	Empty service vehicles	Total service vehicles	Pleasure vehicles	Total vehicles	Passengers	Loaded service vehicles	Empty service vehicles	Total service vehicles	Pleasure vehicles	Total vehicles	Passengers
A. M.												
12–1	4	2	6	9	15	310	13	1	14	9	23	503
1–2	4	1	5	3	8	81	5	1	6	7	13	247
2–3	8	2	10	3	13	49	2	2	4	8	12	133
3–4	5	3	8	2	10	26	10	....	10	1	11	30
4–5	15	12	27	2	29	27	4	1	5	4	9	40
5–6	16	8	24	3	27	90	9	....	9	....	9	310
6–7	10	15	25	3	28	904	18	2	20	6	26	1,823
7–8	13	15	28	14	42	3,011	26	10	36	11	47	1,823
8–9	14	14	28	20	48	5,744	37	12	49	8	57	849
9–10	37	6	43	17	60	2,456	36	9	45	14	59	1,401
10–11	26	13	39	24	63	1,519	43	8	51	12	63	1,425
11–12	20	13	33	26	59	1,656	36	4	40	17	57	1,795
P.M.												
12–1	21	13	34	13	47	1,103	49	13	62	37	99	1,411
1–2	18	13	31	24	55	1,299	25	8	33	15	48	1,498
2–3	31	17	48	14	62	1,105	38	4	42	22	64	1,649
3–4	38	10	48	29	77	866	32	7	39	34	73	1,426
4–5	15	15	30	9	39	1,322	27	6	33	22	55	2,446
5–6	26	22	48	14	62	2,936	28	7	35	51	86	6,196
6–7	25	22	47	33	80	4,339	24	7	31	28	59	3,740
7–8	29	9	38	23	61	2,026	15	6	21	18	39	1,614
8–9	25	12	37	29	66	1,076	7	1	8	14	22	1,408
9–10	25	1	26	22	48	1,083	3	1	4	16	20	1,080
10–11	13	3	16	11	27	930	8	3	11	14	25	876
11–12	7	2	9	14	23	483	6	....	6	11	17	737
Total	445	243	688	361	1,049	34,471	501	113	614	379	993	34,460

TABLE 7 — RELATION OF VEHICULAR TRAFFIC TO CAPACITY, HOUR BY HOUR, ON MANHATTAN-STATEN ISLAND FERRY

HOUR	Boats operating		Total number of trips		Vehicles carried		Vehicular capacity per hour		Percentage of space occupied		Percentage of space not occupied	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
A. M.												
12–1	2	2	2	2	15	23	40	40	38	57	62	43
1–2	1	2	1	2	8	13	20	40	40	33	60	67
2–3	1	1	1	1	13	12	20	20	65	60	35	40
3–4	1	1	1	1	10	11	20	20	50	55	50	45
4–5	2	1	2	1	29	9	40	20	73	45	27	55
5–6	2	2	2	2	27	9	40	40	67	22	33	78
6–7	3	3	3	3	28	26	60	60	47	43	53	57
7–8	3	3	4	3	56	47	80	60	70	78	30	22
8–9	4	3	4	4	34	57	78	80	44	71	56	29
9–10	4	4	4	4	60	59	90	78	67	76	33	24
10–11	3	3	3	3	63	63	58	70	109	90	....	10
11–12	3	3	3	3	59	57	70	58	84	98	16	2
P. M.												
12–1	3	4	3	4	47	99	60	90	78	110	22	....
1–2	3	3	3	3	55	48	60	60	92	80	8	20
2–3	3	4	3	4	62	64	58	90	107	71	....	29
3–4	4	4	4	4	77	73	90	78	86	94	14	6
4–5	2	3	2	3	39	55	38	58	103	95	....	5
5–6	3	4	3	4	62	86	60	90	103	96	....	4
6–7	5	4	5	4	80	59	108	78	74	76	26	24
7–8	4	3	4	3	61	39	78	70	78	56	22	44
8–9	3	3	3	3	66	22	70	58	94	38	6	62
9–10	3	3	3	3	48	20	60	60	80	33	20	67
10–11	3	3	3	3	27	25	60	60	45	42	55	58
11–12	2	2	2	2	23	17	40	40	57	43	43	57
Total	......	......	....	....	1,049	993	1,398	1,418	....	....	....	....
Average	......	......	....	....	....	....	....	....	75	70	25	30

average for the Hudson River group. The clocking was made in the summer, and the Staten Island route is a popular one for motorists between New York and the New Jersey coast resorts. Of the service vehicles, about the same percentage (roughly a third) were empty inbound as were empty inbound from New Jersey, but a much smaller percentage were empty outbound. There were several peaks in both directions which, as Table 7 shows, taxed the capacities of the boats, but all of these, with the exception of that from 12 to 1 P. M. outbound, were caused almost entirely by marked fluctuations in the number of pleasure vehicles.

Table 7 is made up in the same manner as Table 4. It shows some conformity of the schedule to the rush-hour passenger requirements, but a fairly uniform service through the day. The vehicular capacities vary considerably even with a given number of trips per hour, because of the variation in the capacities of the different boats. The theoretical capacities were exceeded in several instances on the day of the clocking, and it is apparent that at seasons when the pleasure travel is heavy there is no great amount of reserve space on the boats with their present schedule.

THIRTY-NINTH STREET, BROOKLYN, FERRY

The other municipal ferry, that running between Manhattan and Thirty-ninth Street, Brooklyn, carries a much lighter traffic than the Staten Island ferry, as Table 5 shows. The length of the run is about three miles, and two boats, as previously stated, take care of the schedule.

The passenger travel is light and the pleasure vehicular travel is almost nil. Of the service vehicles, a large percentage are empty, the empties exceeding the loads outbound on the day of the clocking.

Figures were not worked up to show the hourly fluctuations of service and traffic on this or any of the other Long Island lines, or of the upper Hudson lines.

UNION FERRY GROUP, BROOKLYN

The ferries to Hamilton Avenue and Atlantic Avenue, Brooklyn, running from Whitehall Street, Manhattan, and the Fulton ferry plying between the two streets of the name in Manhattan and Brooklyn, are all that remain of the one time larger group operated by the Union Ferry Company. There are now nine boats available for these three lines. All are single-decked sidewheelers of an old type, with limited capacities, ranging from 16 vehicles and 1000 passengers down to 14 vehicles and 800 passengers.

Two boats handle the business of the Fulton Street line, while three are utilized on each of the others, leaving one in reserve. The distances are short, in no case more than a mile.

Of the three lines, the Hamilton Avenue has the heaviest traffic, its vehicular traffic exceeding that of the city-owned Thirty-ninth Street line, and its passenger traffic being much heavier. The lines, particularly the Atlantic Avenue and Fulton Street lines, have suffered great loss of traffic by reason of the bridges and tunnels connecting Manhattan and Brooklyn, and none of them can be considered as of vital importance in the port problem.

GREENPOINT FERRY

The Tenth & Twenty-third Street Ferry Corporation operating the Greenpoint ferry maintains three boats, all single-decked sidewheelers similar in character to those of the Union Ferry Company. The run is less than a mile.

Data are not available as to the distribution of the vehicular traffic. Table 5 shows that this traffic is somewhat less than that of the Thirty-ninth Street ferry, and that the passenger traffic is rather heavy.

LONG ISLAND RAILROAD FERRY

The Long Island Railroad ferry between East Thirty-fourth Street, New York, and the Long Island City passenger terminal, is of less importance than in former years before the opening up of the Williamsburg and other bridges and the extension of the Long Island passenger service into the Pennsylvania Station at Thirty-third Street, Manhattan.

Four boats are now maintained for this ferry, which is straight across the East River and less than a mile long. Two of the boats have two decks and will carry 2000 passengers each; the other two are single-decked, able to carry 1000 passengers each. All have rated vehicular capacities of eighteen trucks. Two boats handle the week-day schedule, leaving two in reserve. The run is less than a mile.

The vehicular and passenger traffic on this line, as Table 5 shows, range about the same as that of some of the other East River lines.

EDGEWATER OR FORT LEE FERRY

In point of traffic the Edgewater ferry ranks next to the Hudson River railroad group and the Staten Island ferry.

The Riverside & Fort Lee Ferry Company, which operates the line, maintains three boats. These are double-decked vessels, but considerably smaller in capacity than the railroad or municipal ferries. The line is about a mile long, being nearly straight across the Hudson River. The week-day schedule calls for three boats a considerable part of the day, leaving none in reserve.

Table 5 shows the passenger traffic to be exceeded only by that of the Staten Island ferry and four of the Hudson River railroad ferries. The line is the main dependence of the growing residential communities on the Palisades in that vicinity, and also serves the large industries on the waterfront.

The vehicular traffic on the clocking days was heavier than that on the Staten Island ferry or on most of the Hudson River railroad ferries. Nearly 75 per cent of this, however, consisted of pleasure vehicles, leaving a service vehicular traffic lighter than that of most of the East River ferries. A large part of these service vehicles, as well as those elsewhere, it will be noted, were empty.

DYCKMAN STREET FERRY

The Dyckman Street & Englewood Ferry Corporation operates the Dyckman Street ferry. This line has been in service only a few years, and is of little importance in the port problem. Its western terminus is in the Interstate Palisades Park, and from it a steep zigzagging ascent is required to the top of the Palisades.

Three boats are operated on the line. All are single-decked sidewheelers of an old type, taken from other service. The run is about a mile, nearly straight across the river.

Conclusion as to Ferries

Ferry transport for freight is not ideal. The boats add to the congestion in the harbor waters, and are frequently held up by fog or ice. Long truck lines in West Street and Whitehall Street awaiting opportunity to get on the boats are daily occurrences and add greatly to the congestion in the streets. On the other hand, the ferries are convenient and flexible, reaching points directly where it is not feasible to place bridges or tunnels, and it is unlikely that they will be eliminated, however many bridges and tunnels may be built.

The service on all of the lines is capable of expansion, and the Commission believes no specific recommendation is required on this point.

There are possibilities of rearrangement of some of the lines, shortening of routes and consolidation of terminals. Consolidation of terminals, however, would add to street and river congestion, and rearrangement of routes would introduce confusion that perhaps would not be warranted by the results. One improvement has already been initiated by the City of New York and the Pennsylvania Railroad in the removal of the lower-deck cabins and the consequent doubling of the vehicular capacities, passengers being carried chiefly on the upper decks. This would not be feasible on ferries of such heavy passenger traffic as the Liberty Street line of the Central Railroad of New Jersey, the Chambers Street line of the Erie Railroad or the Barclay Street line of the Lackawanna, but it could well be done on a number of the routes.

Inasmuch as the peak vehicular traffic does not in most instances coincide with the peak passenger traffic to which the schedules are adjusted, the Commission believes more boats should be run during the non-rush hours on a number of the lines.

Vehicular Tunnels

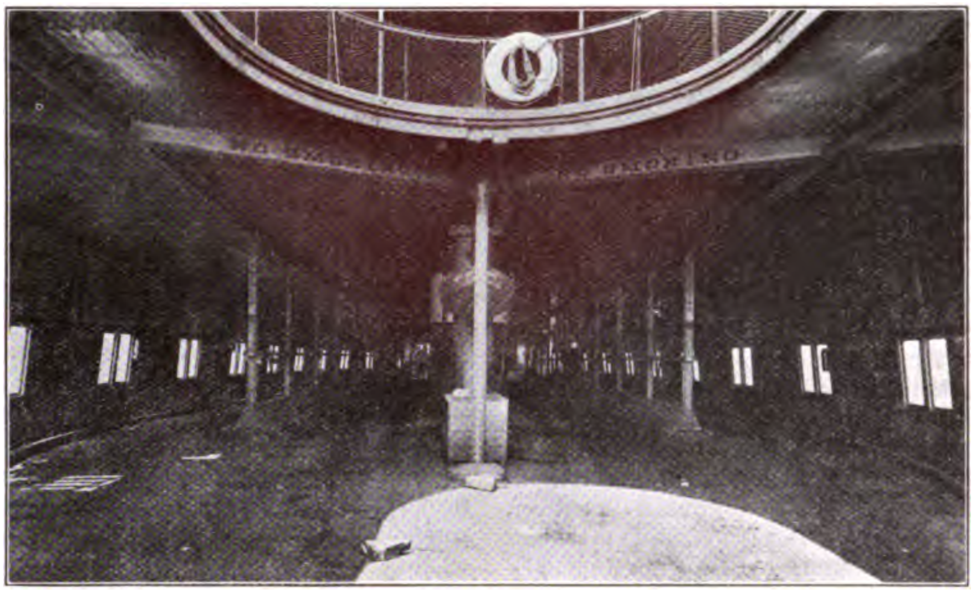
Ground was broken on October 12, 1920, for the vehicular tunnel to be built under the Hudson River from Canal Street, New York, to Twelfth Street, Jersey City. This project, the construction of which under the direction of the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission the two States have authorized, bids fair to divert much traffic from the ferries and reduce the congestion at the ferry entrances. It is also confidently believed by many that this tunnel will be the forerunner of a series of tunnels connecting the two States.

The Commission has not felt it to be within its province to attempt to forecast the effect the vehicular tunnel or tunnels will have on the Port problem as a whole. The four highway bridges between Manhattan

Hudson River Double-Decked Ferry Boats — Passengers on Both Decks — Two Lines of Teams on Lower Deck and Long Island have rendered the East River ferries largely obsolete, but the first bridge did not. Experience with rapid-transit facilities in New York has shown that the traffic increases as rapidly as the systems expand, leaving as large a burden as ever on the older facilities; and the same may prove true with respect to the vehicular traffic of the tunnels and ferries.

Furthermore, the ferries, as the clockings show, carry a heavy passenger as well as a heavy vehicle traffic. Vehicular tunnels offer little promise as a means of conveying passengers, and the one rapid-transit facility in existence between the two States, while operated to near capacity, is not sufficiently profitable to warrant optimism that others will be built. Moreover, free passage over the Hudson is accorded the tens of thousands who live in New Jersey and travel daily via the steam railroads to and from their business in New York, and it is unlikely, in the estimation of the majority of the Commission, that they would willingly surrender this free passage even if other means of conveyance were provided.

The newly adopted city plan for the reorganization of the Hudson River waterfront of Manhattan between Fulton and Perry Streets is based on the ultimate elimination of the ferries; but it is expected that the piers on the sites of any ferry slips will be built only when the discontinuance of the ferries becomes practicable.



Cabins Removed from Double-Decked Hudson River Ferry Boat to Allow Four Lines of Teams on Lower Deck

Chapter 20

Markets and Food Distribution

I — INTRODUCTORY

One of the most difficult as well as important problems of the Port is that of supplying its inhabitants with food and moving through the Port as expeditiously as possible and with a minimum of waste such foodstuffs as are destined to go through it. To supply each of the 8,000,000 inhabitants of the Port District with an average of three pounds of food daily requires 12,000 tons, or enough to fill to the average loading of cars coming to Manhattan a string of freight cars reaching down the Hudson River waterfront of Manhattan from West Thirty-eighth Street to the Battery and up the East River waterfront to East Thirty-eighth Street. Not all of this comes by rail. But however it comes, the greater part of it is perishable, and it must be brought to the consumer at the earliest possible moment, or rushed into cold storage and kept there until time for it to go to the consumer. In addition, hundreds of tons daily must be reshipped by truck, car or local steamer to points outside of the Port District but depending on New York for many of their food supplies, and hundreds of tons for or from foreign countries must be transferred to or from ships and kept moving.

Custom has long since decreed that food for a large metropolitan district shall in the main be consigned to a central point and there be broken up into smaller lots and distributed and redistributed as the case may require to reach all parts of the district. In this manner the market is stabilized, producers are able to see that they get the fair market prices for their goods and primary distributers are able to get the widest choice of goods.

At the Port of New York this central point has been established on the lower West Side of Manhattan in an area reaching from the waterfront to Hudson Street, from Fulton Street to Laight Street. This district is reached for the inflow of food by the majority of the railroads of the Port and the chief food-carrying coastwise steamship lines and certain of the foreign lines. For the distribution of the food it is convenient geographically — though not practically because of street congestion — to the ferries to New Jersey and Staten Island, the bridges to Brooklyn and thoroughfares reaching north in Manhattan.

Milk and certain other commodities do not pass through this primary market.

It is frequently asserted that this concentration of foodstuffs at one point and rehandling to all parts of the Port is an unmitigated evil that must be remedied by the establishing of other primary markets in the Port District, or some other plan that will eliminate the middlemen of the lower West Side and bring the food shipments direct without rehandling to the immediate neighborhood of the consumer.

The bringing together of food receivers and distributers at one point has great advantages, and to attempt a violent disruption of the system would cause great confusion and loss to the food distributers — if indeed it could be accomplished. The problem is to retain the advantages of the present centralization but eliminate the great congestion and repeated rehandling that seem to be part of the system. The Commission is confident that the plan it proposes accomplishes both of these aims. Stripped of its details, the plan involves intercepting rail shipments of foodstuffs at receiving stations at the joint yards, selling them from samples at the primary market and delivering the goods direct from the receiving stations to stations in all parts of the Port District, via the automatic-electric system or in standard cars. Sale by samples will be made dependable by a system of inspection and certification at the receiving stations under the supervision of the Port Authority, and facilities for holding and protecting the goods pending sale will be provided.

II — THE PROBLEM

If all foodstuffs were nonperishable the Port of New York would be confronted with a large task to deliver them rapidly enough to sustain 8,000,000 persons. The task becomes mountainous when we undertake to supply those 8,000,000 persons in all kinds of weather with foods that quickly deteriorate or spoil entirely if delayed in transit, or if improperly or too frequently handled. The handling of perishable foodstuffs is the real food problem.

Volume and Source of New York's Food Supply

Foodstuffs may be classified in one of three groups — (1) nonperishable food, (2) perishable food and (3) live stock and live poultry. The nonperishable foodstuffs comprise flour and other grain products, breadstuffs and canned goods — manufactured products. The perishable foodstuffs include fruits and vegetables, dressed meats, dressed poultry and game, dairy products (eggs being grouped in the carriers' records with butter and cheese) and milk.

Approximately 600,000 tons or 65 per cent of the Port's meat supply in 1914 arrived on the hoof and was slaughtered at one or another of the many slaughterhouses within the Port District. A large amount of poultry was also killed and dressed within the district. The problem of this live stock and poultry is quite distinct from those of other foodstuffs.

Nonperishable food is of course consumed in large quantities within the District — probably in greater quantities than perishable food. The Commission has and sets forth in Chapter 6 information as to the receipts by rail of nonperishables during 1914. A large part was for through shipment. That locally consumed presents no such problem as perishables, inasmuch as the goods are received mainly by a few large distributers and sold according to their labels, so that there is no necessity for refrigeration, reconditioning or displaying, and no wastage through spoiling.

PERISHABLE FOODSTUFFS

The perishable food supply of the Port District comes from three sources: (1) Farmers' wagons or auto trucks, from within a radius of 30 to 50 miles; (2) railroad cars, from every part of the United States and Canada, and even Mexico, and (3) steamships, from the Atlantic and Gulf seaboard, the West Indies, Central and South America, the Mediterranean and other parts of Europe, Hawaii, China, Australasia and in fact nearly every part of the world.

The Commission has no figures available as to the quantity of perishables brought to the markets by local farmers on their own trucks, but is certain that it is considerable. Table 1, while not complete inasmuch as the water-borne figures include only fruit and vegetables, gives an idea of the volume brought and taken away by the common carriers. Naturally the inbound tonnage far exceeds the outbound. The table also shows that the New Jersey railroads handled virtually twice as much as the New York railroads.

TABLE 1 — QUANTITY IN TONS OF PERISHABLE FOODSTUFFS HANDLED INTO OR OUT OF PORT DISTRICT BY RAIL AND WATER DURING 1914

Carrier	Inbound	Outbound	Total
New York railroads	965,207	133,672	1,098,979
New Jersey railroads	1,890,048	280,477	2,170,525
Total railroads	2,855,255	414,149	3,269,504
Ships or other vessels*	296,116	44,680	340,796
Total	3,151,471	458,829	3,610,300

* Figures include only fruit and vegetables.

Table 2 shows the receipts and shipments by geographical subdivisions of the rail-borne portion of these perishables. It is seen that more than 80 per cent of it was shipped to or from Manhattan or the Bronx. We are concerned most in the inbound tonnages. Figures are not available as to the ultimate destination of it. The population of Brooklyn and Queens is not far short, however, of that of Manhattan and the Bronx, nor is the combined population of Staten Island and the New Jersey section of the Port District far below that of Brooklyn and Queens. Evidently, therefore, the other subdivisions received direct far less of perishables than they consumed, and drew heavily on Manhattan and the Bronx. A study of distribution based on a trucking survey indicates that about 20 per cent of the foodstuffs received at Manhattan pier stations moves from these stations to Brooklyn and Queens, and that 5 per cent is returned by truck to the several communities in New Jersey. These percentages, however, take no account of perishables distributed to other sections of the Port from Manhattan from other than its food pier stations.

TABLE 2 — QUANTITIES IN TONS OF PERISHABLES RECEIVED AND DESPATCHED BY RAIL WITHIN DIFFERENT GEOGRAPHICAL SUBDIVISIONS DURING 1914

Geographical Subdivisions	Inbound	Outbound	Total
Manhattan and the Bronx	2,352,852	321,204	2,674,056
Brooklyn and Queens	112,581	24,243	136,824
New Jersey and Staten Island	389,922	68,702	458,624
Total	2,855,355	414,149	3,269,504

Perishable foods for the year 1914 measured by weight and divided into four general classifications were proportioned as follows: Fruits and vegetables, 41 per cent; milk, 29 per cent; fresh meats, dressed poultry and game, 22 per cent; dairy products, including butter, cheese and eggs, 8 per cent.

History of the Market System

The present-day market system, with its primary, secondary and retail markets, its commission men, auctioneers and jobbers, has evolved from the setting aside of a certain space to permit the farmer to bring his goods direct to the consumer. Before long the farmer found it more advantageous to dispose of his load at a reduced rate to one or a few individuals than to spend the time necessary to parcel it out in small lots to the user. Thus entered the middleman. The buyer at the market found that he could turn his money over more quickly by disposing of his goods to the retailer, and so he became a wholesaler. As transportation agencies were developed and it became possible to bring foodstuffs from longer distances, there sprang into being around the farmers' market dealers to furnish what the farmers could not.

As the communities grew and the food-distribution system expanded in every way, the wholesaler now receiving very large quantities, the jobber and the secondary market appeared between the wholesaler and the retailer, relieving the wholesaler of the necessity of splitting his shipment into so many parts. At the same time the retailers at such points found it profitable to group themselves in retail markets. By this time the producer was not selling his goods himself at the primary market, but was delegating the task to commission merchants and auctioneers.

The distinctions between those having to do with food distribution are by no means as sharply defined as the foregoing sketch would indicate. There may be more or fewer middlemen. There may be wholesale and retail operations at the same market, as in the case of some of the newer markets in New Jersey. The system has many variations.

FIRST MARKET FOR FARMERS AND INDIANS

In the early colonial days a market was established at Pearl and Whitehall Streets, New York. Farmers and Indians from Long Island and elsewhere would bring their produce in boats, and the buyers would go down to the shore to meet them. Other markets were developed, so that at the time of the revolution there were five markets, all below the present City Hall.

Toward the end of the eighteenth century the first market west of Broadway was established. This was the predecessor of Washington Market. It was successful, and its business increased so that soon after the beginning of the nineteenth century a new market was planned on the present Washington Market site. The market was completed in 1813, and the standholders in the old market moved to the new. Provision for farmers' wagons was made in the center of the square. The city had grown considerably, and produce came across the Hudson River as well as from Long Island.

In the early days butchers were licensed and were allowed to ply their trade only in the public market, but in 1814 the restriction of the sale of meats to public markets in one ward was suspended because of the lack of a market in that vicinity. By 1835 the unlicensed selling of meat was practised to a considerable extent, and in 1843 an ordinance was adopted authorizing the licensing of private meat shops. There were in 1851 334 licensed shop butchers and 335 public market butchers.

By this time the market had become largely a wholesale market. It was supplying adjoining cities and villages with produce, fruit and the like, and the limit of its capacity had been reached. There was considerable discussion whether or not future business would warrant reconstruction of the plant at an estimated cost of $375,000, but the question was decided in the affirmative. Expansion was meanwhile provided for by the filling in of the space west of Washington Market on the waterfront, and the creation there of what was called West Washington Market, with sheds and butcher stands. It is stated that in 1862 there were 900 stands in the two markets, that 300 wagons could be found there every morning and that during the business season from 1,600 to 2,000 wagons paid daily for the privilege of selling vegetables.

SEPARATION INTO WHOLESALE AND RETAIL ELEMENTS

Then there came a separation of this expanded market into various elements. Wholesalers and jobbers in increasing numbers, who could not get accommodations in the market, began to locate in the blocks north of it. The farmers' section of the market was moved north in 1874 to the present Gansevoort Market, at Gansevoort and West Streets. Ten years later West Washington Market was moved to the same vicinity, but between West Street and the Hudson River. With it went the wholesale meat and poultry business. The original Washington Market, occupying the block bounded by Fulton, Washington, Vesey and West Streets, became purely a retail and small jobbing market. The wholesale distributers of fruit, produce and groceries, who had long looked to the railroads and coastwise steamships rather than to the farmers for the bulk of their supplies, remained in the territory just north of Washington Market which they still occupy.

Upper Manhattan and the Bronx drew their supplies from Washington, West Washington and Gansevoort Markets until 1891, when private interests established the original Harlem Market at 102nd Street and First Avenue. The Westchester Market, at Westchester and Brook Avenues, the Bronx, was established about 1903 by several meat packers for the distribution of dressed meats. The Bronx Produce House was built by the New York, New Haven & Hartford Railroad in 1911 at its Harlem River yard. These three markets, the Harlem, the Westchester and the Bronx Produce House, are now the chief sources of supply for upper Manhattan and the Bronx.

BROOKLYN

Brooklyn, up to 1884, used lower Fulton Street and adjoining streets as a market, permitting farmers and local gardeners to drive there and sell their loads at the curb. The noise and number of wagons became a nuisance, and in 1884 the city established the Wallabout Market on the East River in the vicinity of the Navy Yard. This market developed rapidly in accordance with a carefully worked-out plan. It receives a considerable amount of produce from Long Island farmers, but the bulk of its supplies are trucked from the primary market in Manhattan.

Neither Queens nor Richmond have made a successful attempt to establish markets of their own, and both depend on the primary market — or, in the case of Queens, on the secondary Wallabout Market.

In New Jersey communities the evolution has not proceeded so far, and such markets as exist are in the main both wholesale and retail. Like the farmers' markets on the east side of the Hudson, a large part of the wares are of a sort the farmers cannot supply, and are trucked from the primary market in Manhattan.

MARKETS IN NEW YORK

The markets in the Port District on the New York side of the Hudson River, all of which are within the limits of New York City, can be classified as primary, secondary and retail. The retail markets, of which there are about six in present operation, handle only a very small percentage of the food consumed within the city, and are of little significance in the port problem. It should be noted, however, that the term Washington Market is applied both to the officially designated retail market on the block bounded by Fulton, West, Vesey and Washington Streets, and to the group of stores of wholesalers, jobbers and commission men extending to the north. The latter, though an outgrowth of the former, is now quite independent of it and is the nucleus of the primary market. This primary market is the Washington Market in which the student of the port problem is interested.

There are six of what may be designated secondary markets — West Washington, Gansevoort, Harlem, Westchester, Bronx Produce House and Wallabout.

Besides these markets there are wholesale fish markets and a wholesale oyster market, which will be discussed separately.

There is no secondary market in Staten Island and none in Queens. The city some time ago acquired land for a market near Thirty-ninth Street, Brooklyn, but has not developed it.

CENTRAL PRIMARY MARKET

The central primary market comprises an area of about 58 acres, from Fulton Street to Laight Street and from Hudson Street to West Street, together with a number of Hudson River piers opposite this district which are used primarily for the receipt and sale of foodstuffs. The streets in the district are lined with the stores of food wholesalers, jobbers and commission men, and there are also dry-storage and cold-storage warehouses for holding certain of these foodstuffs. The West Side freight line of the New York Central comes into and terminates in the district, and the New York Central also handles a large amount of food at its pier stations in the vicinity.

Foods coming to the district are handled in a variety of ways. Even foods of the same character originating in different parts of the country are not always handled in the same manner, but each class of trade has its own traditions. Western fruit, for example, comes in almost entirely over the Erie Railroad, which specializes in that service, and is delivered, in cars on floats, at Piers 20 or 21, Hudson River, at Chambers and Duane Streets. The cars are placed at the pier in the evening and are unloaded during the night. Advance notices have been sent to the consignees, whose representatives see that the goods are arranged on the piers conveniently for the sales. Sales begin early the following morning. Citrus fruits are usually sold at auction, although private sales are sometimes arranged when favorable opportunities occur. Other fruits are disposed of either at auction or by private sales. The sales are made to jobbers on the streets just east, to jobbers in the Harlem, Westchester and Wallabout secondary markets, to a few large retailers and a few large hotels, and to dealers from Yonkers, Newark, Paterson, Perth Amboy, New Brunswick and even Stamford and Bridgeport.

The buyers from distant points generally use large motor trucks, reach the market early and remove their goods promptly. Those in the primary district near by, using horse-drawn trucks to a greater extent, generally make several trips to the piers and pile their wares along the sidewalks for the next day's sales. The walks are well filled by nightfall, and trucks may be found throughout the day transporting these goods from one to fifteen blocks.

Early the following morning — at one o'clock in summer and five o'clock in winter — sales begin from the sidewalks of these central-market jobbers. The buyers are the jobbers of the secondary markets in New York, of the markets of the New Jersey communities and of communities outside the Port District — some of the same dealers who were at the pier sales the day before, but in general the smaller ones, who are unable to buy in the quantities required at the piers. By 8 A. M. the stocks of these local dealers are usually well depleted, and the goods are taken inside the stores. During the day a fresh stock is assembled on the sidewalks, and the next night the sale is repeated.

Thus if a carload of oranges arrives at Jersey City Monday the oranges are auctioned off at Pier 20 or 21 Tuesday morning. They may go upon the table of the large hotel or into the store of the large retailer the same day. Some of them, however, will probably go to the Washington Street jobber and stand on the sidewalk most of Tuesday and Tuesday night. A small jobber from Wallabout Market may buy them from the Washington Street jobber and remove them early Wednesday morning, trucking them the four miles or so to his stand. They will go on sale at Wallabout that day, but will probably not be bought and taken away by the Brooklyn or Queens retailer until early the following morning, so that the consumer will not get his chance at them until Thursday. They have been in the Port District three days, during which time they have stood on sidewalks and been handled and rehandled, trucked and trucked again, subject to excessive heat in summer, excessive cold in winter.

Florida fruit and produce follow substantially the same course, but arrive at Pier 27, 28 or 29 of the Pennsylvania at Hubert and Laight Streets. Produce from southern New Jersey, on the other hand, arriving over either the Pennsylvania or Central of New Jersey, is unloaded at team yards in Jersey City and trucked over to the primary market, usually to commission men. Ordinarily this procedure consumes more time than the other.

A large amount of food also comes in via the coastwise steamships — the Clyde and Mallory lines from the south, the Fall River line and the Eastern Steamship Company from the north. Some also comes down the Hudson via the Central Hudson Steamboat Company and the Catskill Evening Line.

The streets in the primary market district are narrow, especially Washington Street, around which the stores are grouped. The stores are mostly old two, three and four-story structures, which serve mainly to receive the goods left over, the selling being done on the sidewalks. The sidewalks are piled high and often nearly blocked with the goods, and the streets are badly congested, as some of the accompanying photographs show. There is congestion at the piers, caused by the attempts to remove the foodstuffs through a few bottle necks; congestion at the ferries, caused by the large amount of food trucked from the team tracks in New Jersey to the primary market and back from the primary market to New Jersey retailers; congestion in the interior streets, caused by the currents and cross currents of trucks delivering goods to and taking them from the piles on the sidewalks.

SECONDARY MARKETS

West Washington Market — West Washington Market, originally the overflow from Washington Market, retained its name when moved uptown to its present site, bounded by Bloomfield, West and Gansevoort Streets and Thirteenth Avenue.

This market is devoted almost exclusively to meat and live poultry, handling only a small amount of dressed poultry, eggs, fruit and vegetables. The large meat packers rent a number of stalls with New York Central track delivery, and with the many meat jobbers occupy about two-thirds of the market and do perhaps two-thirds of the business. The market also supplies the 1,500,000 Hebrew population of New York with live poultry through some 175 chicken slaughterhouses throughout the city. The greater part of the poultry comes to Hoboken over the Lackawanna Railroad and is trucked from the special poultry yard there.

The market covers an area of nearly 3½ acres, on which are ten two-story brick buildings in blocks 180 x 50 ft. of forty stands each, with streets between about 40 ft. wide. The buildings are in fair condition. Both land and buildings are owned by the city, but all interior improvements, including refrigerating facilities, were put in at the expense of the lessees. At the time the market was visited by the Commission's investigator all of the buildings were occupied. In 1918 the operation of the market showed a profit to the city.

Though located on the waterfront, West Washington Market makes no use of water facilities. All supplies are trucked to it except those to the companies that have New York Central trackage. The market obstructs the Marginal Way and blocks waterfront improvements long since planned. Opposition to its removal has thus far been successful.

From certain angles West Washington might be considered a primary market.

Gansevoort Market — Diagonally across West Street from West Washington Market is Gansevoort Market, on an open square of about 2⅓ acres in the block bounded by Little West Twelfth, Washington, Gansevoort and West Streets. This is strictly a farmers' and gardeners' market, so reserved by ordinance, and supplied with roadways and walks for their convenience. There is room in the market for about 300 farmers' wagons.

At the height of the season some 250 farmers' trucks loaded with produce are found here, half of them coming from Long Island, nearly as many from New Jersey around Hackensack and a few from Staten Island, all within thirty miles of New York. Business begins at daylight, and by 9 A. M. the farmers have mostly sold out to retailers and hucksters. The retailers are chiefly from south of Seventy-second Street, Manhattan, and from Jersey City and Hoboken.

The city makes a small charge for each team, but in 1918 it did not clear the expenses of operating the market when account is taken of interest and loss of taxes.

In the adjacent streets are numerous wholesale stores handling the meat, fruit and groceries that the farmers cannot furnish, and doing a heavy business.

Harlem Market — Harlem Market at First Avenue and 102d Street, Manhattan, is a private enterprise established in 1891 by the Harlem Market Company, Ltd., as a farmers' market. The market proper occupies the block bounded by 102d, 103d and Exterior Streets and First Avenue, about 3½ acres, and houses about thirty-three wholesale produce stores. The interior of the block is reserved for the farmers' trucks.

Produce is brought by the farmers, of whom about 75 per cent come from Long Island, 15 per cent from the Bronx and Westchester County and 10 per cent from New Jersey. They bring a maximum of 200 loads daily.

Grouped about the market in the neighboring streets are about 100 stores, and these with the thirty-three in the market proper supply the goods that the farmers cannot. The sales are mostly wholesale, to retailers between Seventy-second Street, New York, and New Rochelle. It is estimated that from 1,200 to 1,500 wagons come here from retail stores, in addition to about 200 pushcart and wagon peddlers.

Westchester Market — About 1903 several meat packers established distributing stations at Westchester Avenue near the present railroad freight yard. Six years later the yard was built and the distributing stations were transferred to the west side of Brook Avenue. Tunnels were provided under the street to the yard tracks. A large refrigerating plant was built at this time on the south side of Westchester Avenue, with rail delivery. This building houses wholesale meat establishments facing on the avenue and provided with truck platforms in the rear, as well as with track facilities.

Westchester Market is now the distributing center of the Bronx for Western dressed meats and poultry. It also does a large business in dairy products, nonperishables and fish. The meats and poultry are received direct by rail by the packers. The dairy products and nonperishables are in part received direct and in part bought and trucked from the primary market. The fish is trucked from the Fulton fish market.

Bronx Produce House — In 1911 the New York, New Haven & Hartford Railroad built the Bronx Produce House at its Harlem River yard. The wholesale fruit and vegetable dealers in the Bronx were brought together here, and the plant is now the wholesale market for potatoes in the Bronx and upper Manhattan. It also handles considerable quantities of apples, cabbages, onions, turnips and seasonal specialties. The northern potatoes come mainly direct by rail, in carload lots; other products also come direct by rail but are to a large extent trucked from the primary market.

The Bronx has shown perhaps more tendency than any other borough of New York to break away from dependence on the primary market. This is partly

Citrus Fruits from California on Display for Auction at Railroad Pier — Hudson River, Manhattan

attributable to the direct rail service of two railroads together with the float-bridge terminals of several others, and partly to the long trucking distances from the primary market.

Wallabout Market—Wallabout Market is a farmers' and jobbers' market. It is located on Flushing Avenue, east of the New York Navy Yard, on a tract bounded by Flushing, Clinton and East Avenues and Wallabout Basin. Since it was established in 1884 it has been enlarged from time to time and it now covers about 29 acres. It has modern brick buildings of uniform design.

Toward the rear of the market is the largest farmers' market in New York, occupying an area of 4½ acres. This will accommodate about 400 teams, and is full at times. Long Island produce is brought here direct, from distances up to 30 miles. The market supplies virtually all of the retail stores in Brooklyn, but there are practically no sales direct to consumer. There are 326 lots, nearly all of which are built on. There were 130 lessees at the time the market was visited. The market has kept pace with the growth of Brooklyn, and there has been little overflow into stores outside of the market.

The city owns the land. The tenants own the buildings, but are obliged to make them conform in appearance with the standard adopted. The market has been operated at a small annual loss, after interest on investment and loss of taxes are taken into account.

Five railroads, New York Central, Pennsylvania, Erie, Lehigh Valley and Baltimore & Ohio, have freight stations near by, and the Lackawanna has one not far away. Two meat-packing establishments have facilities for taking their goods direct from cars on floats. Nevertheless, as set forth previously, the jobbers depend largely on the primary market in Manhattan for their goods, and probably three-fourths of the fruit and produce handled is trucked from the primary market or the Hudson River piers.

PUSHCART AND WAGON PEDDLERS

Pushcart and wagon peddlers, particularly the former, are important factors in the retailing of perishable foodstuffs. The pushcart peddlers operate in the lower East Side of Manhattan and other crowded sections. Their carts are ranged along the curbs, and are virtually the retail stores of their districts for the commodities they handle. Naturally the peddlers can carry only small stocks, but they have little overhead expense.

The wagon peddlers pass through the streets in various parts of the city and call out their wares. They ordinarily keep moving and do not concentrate in certain districts. They compete with the fruit and vegetable stores in specialties, rather than take the place of the stores.

The pushcart and wagon peddlers obtain their supplies either from the farmers at the farmers' markets or from the smaller jobbers in the primary or secondary markets.

Markets in New Jersey

Nearly all of the larger communities in New Jersey have markets which correspond in a general way with the nucleus is a farmers' market, but generally also, as in the case of the secondary markets in New York, the farmers sell their loads to dealers rather than to individual consumers, and around the farmers' open spaces have grown up wholesale stores to supply what the farmer cannot. Here, as at Wallabout and Harlem Markets, the wholesalers obtain their goods in the main from the primary market in New York. For example, fruit, vegetables and fish are trucked in large quantities from New York to the Center Market in Newark, the largest of the New Jersey markets.

Although all Southern fruits and vegetables brought to the Port by the Pennsylvania Railroad pass through Newark and Jersey City, and perishables brought by the other New Jersey railroads pass through one or more of the New Jersey communities, nearly all of the railroad-borne food consumed in the New Jersey section of the Port District comes to New York City first —even to the team-track goods unloaded in Jersey City or Hoboken and trucked to the Washington Street market.

the secondary markets in New York City. Generally

Different Procedure Regarding Certain Foods

Certain important foods either do not pass through markets at all or go through special markets. The most important of these foods, some of which have already been touched upon, are milk, dressed meat, live stock, fish and oysters.

MILK

Milk comes to the Port District chiefly by rail in special fast trains, the cars being of the general character of express cars. The trains arrive mostly at night and the milk, in cans, is unloaded at covered platforms at the waterfront yards. From the platforms it is hauled in trucks of large or small capacity to the stations of the distributing companies scattered throughout the district. There are two large distributing companies and nearly a score of small ones. From the distributing stations wagons go out to make house-to-house and store-to-store deliveries of bottled milk, while loose milk is also available in cans for the retail stores and restaurants.

The Port of New York draws its milk supply from a wide area reaching 200 or 300 miles from the Port in almost every direction. (At the time of the milk strike early in 1919, when the regular producers held back their supply, milk was brought from as far west as Ohio and Michigan.) The New York Central, West Shore, Ontario & Western, Lackawanna, Erie, Pennsylvania, Lehigh Valley and Central of New Jersey each brings from one to four train loads daily. The greater part of it is unloaded in New Jersey and trucked across the Hudson River.

DRESSED MEAT

Dressed meat comes in the main to the numerous stations of about six large packers distributed through different parts of New York, Jersey City and the other communities of the Port. Cold-storage facilities are a necessary adjunct of the dressed-meat trade, and usually the cars of meat are unloaded at stations provided with cold-storage facilities.

This system largely eliminates the central primary market as a factor in the distribution of dressed meat. West Washington Market may be regarded as the primary market for this trade, although the meat jobbers in the secondary market may get their wares from any of the packers' distributing stations.

LIVE STOCK AND LIVE POULTRY

Live stock comes to one of several stockyards on the New Jersey waterfront or to that of the New York Central at Sixtieth Street, Manhattan. There are a number of slaughterhouses throughout Manhattan and Brooklyn, almost all of them on the waterfront. Ordinarily the animals are floated to them on special cattle barges, although during the marine strikes of 1919 special permits were granted to allow them to be driven through the streets at night.

There are also slaughterhouses at or near the stockyards in New Jersey, near also to cold-storage plants.

Live poultry is brought to the Port District largely by the Lackawanna Railroad, which has a special poultry yard and platforms in Hoboken. The poultry is trucked from this yard to the wholesale poultry market at West Washington Market and subsequently killed at one of the numerous chicken slaughterhouses throughout the Port District. The railroad makes an allowance for the cost of trucking from the railroad yard to the market.

FISH

Practically the entire supply of fish for New York City and vicinity, as well as a large amount for interior points, passes through the Fulton wholesale market, at the foot of Fulton Street, East River, Manhattan. The market occupies Piers 17 and 18 and the bulkhead sheds adjoining. It was established in 1821.

The piers are narrow, open piers, and are used only for unloading the small percentage of fish brought in direct by fishing vessels. The business of the market is transacted mainly in the bulkhead sheds, which are steel-frame and concrete buildings divided into some

Street and Sidewalk Occupation by Drays and Foodstuffs in Washington Market, Manhattan.

Fruit and Vegetables on Sale in Washington Market — Note Extent of Sidewalk Occupation forty stalls occupied by two or three large dealers and a number of independent dealers. On the west side of South Street is the original Fulton Market, a structure now used mainly for other purposes than the handling of fish. The piers, bulkhead sheds and the original market building are all owned by the city.

As previously stated, only a comparatively small amount of fish is brought to the market direct from the sea. The greater part of the supply comes by rail — from New England, the Great Lakes, California and numerous other districts. It is shipped largely by express. It is packed with crushed ice in wooden boxes and the boxes are carried in refrigerated cars. A large amount of fish is also brought in daily by the Fall River and other Sound steamers. As the market is not adjacent to either the principal railroad stations or the piers of the Sound lines, the fish have to be trucked to the market. After sale they must be removed by the same means.

Conditions are not attractive at the fish market. The cramped quarters and complete lack of protection against flies in the bulkhead sheds, the frequent emptying of fish on the unclean floors of the piers, the repeated pitchforking, causing the breaking down of the flesh tissues and the beginning of decay, are all factors in the unattractiveness.

Arrivals of fish are very irregular. At times the market is glutted, and the surplus fish are trucked to one of three or four plants existing for the purpose, and there frozen. These facilities are inadequate in capacity, and are often unable to handle all of the entire surplus. They are also somewhat remote from the market — one in fact in New Jersey outside of the Port District requiring reshipment by express to the plant. When the frozen fish leave the cold-storage plants as the demand dictates they again pass through the Fulton Market.

There is a fresh-water fish market at Peck Slip, in old stores. The supply comes in by rail, mainly by express. The buildings are old and almost wholly lacking in sanitary arrangements. The fish are handled largely on the sidewalks, exposed to the sun and in the way of pedestrians. This market may be regarded as part of the Fulton market, as fresh-water fish are also handled at the Fulton market proper.

OYSTERS

Waterfront facilities for the oyster industry are reserved by the charter of the City of New York. Formerly the space reserved was on the Hudson River waterfront at Gansevoort Street. About 1912 it was removed to the foot of Pike Street, East River, Manhattan. Part of Pier 32 and adjoining bulkhead space are occupied by oyster boats. The dealers own or lease the oyster beds, cultivate and gather the oysters and bring them to market with their own boats and men.

About a million bushels of oysters and clams pass annually through the market, 50 per cent for the Port District and 50 per cent for shipment to interior points. Perhaps 250,000 bushels pass direct to the consumers. Oysters are also sold at wholesale in the Fulton Fish Market and adjacent wholesale stores.

POTATOES

Potatoes, onions and certain other food shipped in bulk are to a large extent unloaded at the team-track yards of the New York Central and other railroads on the West Side between Twenty-fifth and Fortieth Streets, at the Bronx Produce House and at team-track yards in Brooklyn. They are sold in various ways to jobbers, retailers and hucksters.

Susceptibility of System to Derangement

This complicated system of food distribution is easily deranged. Aside from the unco-ordinated dumping on the market at one time of goods from all parts of the country and the withholding at another time of goods for more favorable prices, which result in a succession of glutted markets and shortages; and the wastage, loss of freshness or total destruction of perishables because of excessive heat, excessive cold or other adverse circumstances; the Port had several instructive if painful opportunities last year to see the possible effect of strikes among those employed in the operation of the system. Because of a dispute between the milk distributers and the dairymen who supply them, the normal supply of milk was cut off, and such as could be had was brought from more distant points. Several strikes of the men operating harbor craft brought about a complete suspension of car-float service, so that food arriving at the New Jersey waterfront could come no farther except by the one ferry running, by the emergency use of the Pennsylvania tunnels or by rerouting via Poughkeepsie or some other point up the Hudson River. In a later strike the food arrived at the pier stations, but came near rotting there because striking longshoremen would not unload the cars.

Several pages in the Commission's progress report of April 8, 1919, were devoted to the general strike of marine workers of January 9–11, 1919, and it is not necessary to review those details. Neither this strike nor any of the others lasted long enough to result in actual famine, and in fact they were more or less reassuring as showing that reserve stocks are likely to be available and means can be found to tide over emergencies. Nevertheless, the strikes might have lasted much longer than they did, and it is certainly questionable whether the entire Port District should be so nearly dependent upon the continuous functioning of so vulnerable a system, with its one relatively small and overworked primary market.

Supervision of Food Supply and Distribution

Several agencies, Federal, State, municipal and private, are in existence for the purpose of supervising and controlling the supply and distribution of food.

FEDERAL SUPERVISION

The Bureau of Markets, United States Department of Agriculture, has an office in New York City with divisions covering (1) dairy products, (2) fruits and vegetables and (3) live stock and meats. Each division issues daily market reports giving wholesale market prices, quantities received, conditions at shipping points and comparisons with other wholesale markets.

The Department of Agriculture has established standard grades of many products, as well as standard packages, and it often acts as arbiter between shipper and consignee in the matter of disputes over the quality of goods. Meat is inspected where the animals are slaughtered, and the cattle markets are licensed and supervised. Much work has also been done in the matter of better packing and transportation of perishables.

STATE SUPERVISION

New York—On June 6, 1917, the Farms and Markets Law of New York was passed. It consolidated the former Departments of Agriculture, Foods and Markets, and Weights and Measures, and the cold-storage administration carried on by the State Department of Health, into the new Department of Farms and Markets. This is controlled by a council of eleven members, serving for 10-year terms. The department has two divisions, the Division of Agriculture and the Division of Foods and Markets, the former having to do with the production of foods and the latter with the inspection and marketing of them. The Division of Foods and Markets has six bureaus as follows: (1) Bureau of Markets and Storage, (2) Bureau of Co-operative Associations, (3) Bureau of Licenses, (4) Bureau of Weights and Measures, (5) Bureau of Food Products and (6) Bureau of Food Standardization. The division at large has an office in New York City which carries on the work of all the bureaus.

The division's work is partly in the nature of enforcement of existing laws, such as the cold-storage laws, the laws relating to the licensing of commission merchants, milk-gathering stations and public cold-storage warehouses, and the weights and measures laws; partly laboratory work for research purposes or for the preparation of cases against food adulteration; and partly an educational and news service. In connection with the latter function the division issues daily, weekly and monthly bulletins apprising farmers and producers throughout the State of market prices and the conditions and needs of the market.

New Jersey—New Jersey has a Department of Agriculture, organized in accordance with the laws of 1916. It has three bureaus covering (1) the animal industry, (2) lands, crops and markets and (3) statistics and inspection. The State Board of Agriculture controlling the department has eight non-salaried members, chosen at a convention from delegates representing county boards and local granges, and nine or ten associations concerned in food supply. The Department of Agriculture has been active in the establishment of farmers' markets in the New Jersey cities, and has a weekly market-news service for the benefit of New Jersey farmers, who supply a great amount of produce to the Port.

MUNICIPAL SUPERVISION

New York City—New York City exercises jurisdiction over markets and food distribution through two departments, the Department of Health and the Department of Public Markets. The Department of Health has authority to enforce the laws against food adulteration, misbranding and the marketing of spoiled food. This function parallels one of those of the State organization. The Department of Public Markets has to do with the leasing for market purposes of land and physical plant.

New Jersey Cities—The public retail markets in the New Jersey cities are generally under the direction of the sealer of weights and measures of the city. Newark, however, has a market clerk directing its Center Market.

The functions of the different agencies, particularly in New York, overlap to some extent, but not enough to result in conflict or extensive duplication of service. The definite powers of the various agencies are mainly along rather narrowly prescribed lines. For example, either the State or the city can punish specific violations of laws forbidding the display of food unfit for consumption, but neither can prevent practices that tend to render the food unfit, such as excessive exposure.

Distributers' Organizations

The New York Distributers' Association was formed in November, 1917, aided very largely by a food-problem committee of the Merchants' Association in New York City. The distributers' associations have a membership of more than 100, with more than thirty-three special associations represented. There is hardly a food product that lacks its association of dealers, and there are also associations of hotel men and restaurateurs.

III—SUGGESTED SOLUTION OF PROBLEM

From the description of the problem as set forth in Section 2 of this chapter it has been seen that the present plan of receiving and delivering the vast volume of perishable foodstuffs that has to be handled at the Port is cumbersome, expensive to operate and easily deranged, while the physical facilities are obsolete and inadequate. Great loss from spoiling may quickly result from excessive heat or cold, lack of freshness in the commodity, wide changes in prices or glutted markets.

The Commission believes three elements are necessary in a satisfactory system, none of which is found in the present system. These are (1) co-ordinated physical facilities at the railheads, (2) a reliable sampling, grading and certification service and (3) an effective method of distribution within the Port. The first of these elements can be accomplished by building belt lines connecting the New Jersey railroads as one group and the New York railroads as another, and establishing in a joint yard on each belt line receiving stations or depots devoted to the distribution or storage of perishable foods of all kinds. The second element can be provided by the inauguration of a publicly-controlled inspection service at these receiving stations. The receiving stations will naturally be located in or near the joint yards of the automatic-electric system, and the third element will be afforded by the automatic-electric system and its terminals within the territory it reaches and by the various belt lines elsewhere in the Port. A fourth element, which the Commission believes will be a natural growth following the establishment of the other parts of the system, will be a series of special market terminals in different sections of the Port District.

It may appear at first glance that this is a violent disruption of the present system, such as the Commission has in the previous pages condemned. Further consideration will show that this is not true. The primary and secondary markets, and the auctioneers, commission men, wholesalers and jobbers doing business in them, can remain at their present locations until such time as the economies that may be effected automatically compel the relinquishing of the present antiquated and congested facilities. Instead, however, of the operators of the primary markets having to receive and care for their entire shipments in quarters poorly fitted for the purpose, and in many instances display the entire shipment for prospective buyers, they will have to house and display only certified samples, while the rest of the shipments remain under proper temperature and other conditions at the railroad receiving stations; and instead of having to truck long distances goods that have already begun to deteriorate through handling and exposure without proper temperature conditions, the dealers of the secondary markets and the retailers buying at the primary market will have delivered to them at stations in their immediate vicinity goods that have meanwhile been retained at the railroad receiving stations and are as fresh as when they reached the Port.

Receiving Stations

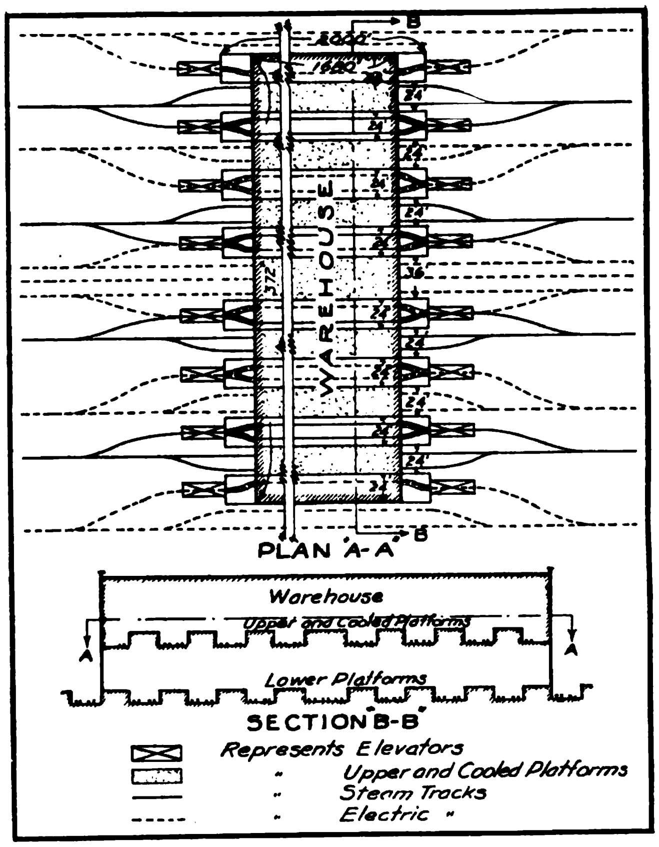
The receiving stations should be provided with ample cooling and icing facilities, storage space (dry and cold), display space and facilities for reconditioning, grading, sampling and certification. The facilities should be so designed that all classes of perishable food, whether in large or small quantities, can be kept at the station for such length of time as either circumstances demand or the nature of the products will permit. Means should be provided for transfer without change of temperature from standard railroad equipment to special containers that should be used for transportation to the market centers located in the several sections of the Port at the various temperatures required for the best results. Cold storage should be provided to care for large surpluses of commodities reaching New York by rail and intended for storage for more or less extended periods.

Cold-storage warehouses at these stations will have many advantages over the scattered warehouses at present available. One will be the lower overhead because of the lower value of the land in the Hackensack Meadows and at the joint yard for the New York railroads. Another, applicable at least to the New Jersey group of railroads, which we have seen brings twice as much perishable food to the Port District as the New York group, will be the more readily available fuel supply. A third, of great importance to the food dealers, will be the elimination of trucking from the present pier stations to the warehouses, which, exposing the goods to unfavorable temperatures, causes the beginning of the deterioration which creates largely undeserved prejudice against cold-storage food.

It is not the intent to store at the receiving stations all surplus foodstuffs for the Port District, but only the excess which might more economically be received and held at reservoirs outside of the crowded area adjacent to the market centers. It is to be assumed, of course, that not all of the perishable food arriving at or departing from the Port District by rail must necessarily pass through the receiving stations. Where the service provided at the stations is not required or desired, the commodities can move through the regular channels over the transfer platforms of the automatic-electric or belt-line system and thence to destination.

Suggested Layout for Receiving Station

Since the expanded automatic-electric system has stations throughout Manhattan and a station near the present markets in the Bronx, a large percentage of the food deliveries within the Port will presumably be made via the automatic-electric system, and the Commission's plan contemplates using several of the transfer platforms at the joint yards as the nuclei for the food-receiving stations.



Suggested Layout for New Jersey Receiving Station

So many elements — the different kinds and grades of commodities, the different requirements to prevent deterioration, seasonal fluctuations and the like — enter into the question that it would have been futile for the Commission to attempt to evolve finished plans for these receiving stations in the limited time available for study of this among the other port problems with which the Commission has had to deal. Evolving the best designs for these stations will be a fitting task for a department under the permanent Port Authority, aided by the advice of the food distributers. The Commission has, however, prepared a suggested layout for the New Jersey station, which it presents in the accompanying drawing. The layout is deemed ample to handle the expected inflow of perishables in 1924.

It is proposed to double-deck the automatic-electric transfer station for a width of eight platforms, providing platforms and flanking tracks at the upper level as at the lower level. The upper-level platforms, however, will be located centrally over the lower-level track wells, and the upper-level track wells centrally over the lower-level platforms. It will then be possible to place at each lower-level platform a car elevator from which access will be had to the adjacent upper-level pairs of tracks, and to which spurs will run from the lower-level tracks in the manner shown.

The lower level will be used for the transfer of ordinary freight in the manner described in Chapter 14 on the automatic-electric system, although its most natural use will be for such foodstuffs as require neither refrigeration nor detention. The upper level and additional floors above it will constitute the receiving station proper, where highly perishable goods can be transferred from standard freight cars to refrigerated trailers or truck bodies and forwarded via the automatic-electric system without change of temperature, and with or without a period of storage.

PLAN OF OPERATION

The plan of operation is just the same at the upper level as at the lower level, except that cable hauls will be required to move the standard-equipment cars, the tracks for the automatic-electric cars being electrified so that they can operate under their own power as elsewhere.

An inbound standard-equipment car loaded with perishable foodstuffs that are to be held at the receiving station, or goods that require continuous refrigeration, even though they are not to be held, will be switched to one of the elevator tracks at the south end of the transfer station and elevated to the upper level, where it will be hauled alongside a platform by means of one of the cables. Its contents will be unloaded upon trailers, after which the car will be hauled through to the corresponding elevator at the north end of the transfer station, lowered to the ground level and removed by a yard engine.

When the goods are ready to be delivered locally they will be loaded either into automatic-electric cars or standard-equipment cars, depending on whether delivery is to be made on or off the automatic-electric system. In the latter case the goods will be loaded upon trap cars that pass through the same cycle as the standard cars bringing the goods in. In the case of the automatic-electric system, the automatic-electric car will be switched to one of the elevators at the north end of the transfer station, be elevated to the upper level and thence proceed to the proper point along the platform to receive its load. Having received its load of trailers, it will pass to the corresponding elevator at the south end of the layout, be lowered to the ground and thence move to the departure yard. Standard-equipment cars bringing foodstuffs to the upper level will necessarily depart empty unless they are reloaded as trap cars for local points, and automatic-electric cars coming to the upper level for such perishables will necessarily arrive without load, although they may previously have brought loads and looped back empty around the transfer station on the track provided for that purpose.

It is proposed to house the entire double-deck layout in a cold storage warehouse 1,680 ft. long by 372 ft. wide, and five stories high. The first (ground-level) story is to be open and well lighted. The upper-level platform story is to be enclosed and well lighted and cool enough at all times to prevent damage to refrigerated goods during transfer. The next three stories are to be provided with cold-storage rooms at the requisite temperatures. These three upper stories are to be served from the upper-level platforms by elevators, tractors and trailers.

Breaking bulk of such commodities as dressed beef and exposing them to outdoor temperatures at certain seasons of the year for even the few hours required to deliver them at one of the automatic-electric stations would be highly objectionable. This objection can be overcome by transferring the goods from the standard-equipment cars to special refrigerated truck bodies for the automatic-electric cars and making the transfer at a platform maintained at a low temperature. Under such conditions there need be no deterioration of the commodities.

CAPACITY OF STATION

The elevators for the standard-equipment and automatic-electric cars would be the limiting factor of the warehouse capacity. They would be of a type similar to those of the Manhattan terminals of the automatic-electric system. They would be sixteen in number, eight at each end of the transfer platforms. They could make with a 34-ft. lift about 40 round trips per hour, which, assuming 10-ton loads for the standard-equipment cars and 7½-ton loads for the automatic-electric cars, would give respective capacities of 400 and 300 tons per hour.

The four center elevators, connected each to one steam track and one electric track and carrying conflicting movements, can be conservatively figured as of one-half the capacity of each of the others, reducing the effective number of elevators to 14, which is equivalent to 3½ elevators inbound and 3½ elevators outbound for steam service and the same number for electric service. If we assume that the work of the station must be transacted at night inside of an eight-hour period, the total elevator capacity will be 11,200 tons for standard equipment and 8,400 tons for automatic-electric equipment.

It is estimated that there will be in 1924 on peak days approximately 7,370 tons of perishable foodstuffs requiring transfer in cool rooms from standard equipment to automatic-electric refrigerated bodies. Consequently at that time there will be excess capacities on the eight-hour basis of 1,030 tons for the automatic-electric cars and 3,830 tons or 383 cars for the standard equipment. This will be sufficient to take care of storage necessities. If three warehouse floors are built above the platform floors there will be, if the average standard-car area is taken at 300 sq. ft. and 75 per cent of the gross warehouse floor area is assumed to be available for storage, room for 4,680 car loads of foodstuffs.

Inspection Service—Sampling, Grading and Certification

An important phase of the service, one which necessarily must be a matter of growth, is the system of sampling, grading and certification. It is thought that this service can be so developed that the Port Authority or other public agency in charge of the operation of the receiving station, through co-operation with the commercial interests, will perform an important function in the distribution of perishable food throughout the Port District, and also in the matter of reconsignments. The public agency will break seal on the shipment at the time of arrival, sample it and after drawing a certificate as to grade and quality, despatch the required sample to the jobber or wholesaler consignee at one of the market centers, who will dispose of the shipment by sample on the strength of the agency's certificate.

Such a plan will avoid clogging any of the market stations with produce disposed of for consumption outside of the Port District, particularly consignments that now reach the market for no other reason than to allow an inspection of the goods prior to a commercial transaction incident to a change of ownership. It will also make possible a more direct and therefore a quicker and more economical distribution of all produce to the market places. Bound up with a service of this sort is the further service of reconditioning.

Market Terminals

Experience has shown that prospective buyers of any commodity will naturally seek a market where there is the greatest opportunity for selection and bargaining, and that sellers conversely will seek a point where the greatest number of buyers congregate. This is perhaps even more true in the case of perishable foodstuffs than in that of the average commodity, inasmuch as the condition of the goods has so much bearing on the buyer's opportunity to resell them at a satisfactory figure. Recognition of this truth alone explains the centralization of the business of food distribution, and explains also why the commercial interests engaged in it would oppose any radical plan for decentralization of the primary market.

The assertion that New York's food market ought to be wholly decentralized has its justification largely in the lack of common receiving stations and in the present poor means of transportation between the point of receipt and all sections of the Port. Given adequate and properly designed receiving stations as are herein advocated, and a quick, easy and cheap means of transportation from such stations to other sections of the Port, such as is provided in the automatic-electric and belt-line systems, a reforging of the present chain extending from producer to consumer can be made evolutionary.

Much needed modern physical marketing facilities involving large expenditures should be developed in the various sections of the Port District as rapidly as possible. There should be provided properly located terminal market structures devoted exclusively to wholesale marketing purposes, each with accessible rail facilities provided on equal terms to all — facilities that will include dry and cold storage and space for conditioning, sampling, displaying, auctioning and other selling.

TERMINALS IN ALL SECTIONS

It is possible to establish terminals of this character in Manhattan, the Bronx, Harlem, Brooklyn, Queens, Richmond, Newark, Jersey City, Hoboken and various other New York and New Jersey communities. In Manhattan and the Bronx they can be located along the system of transportation provided in the automatic-electric plan. In other communities they can be placed along the tracks of any of the Port's railroad systems or any of the belt lines recommended by the Commission connecting these railroad systems, all of which will have access to the receiving stations proposed for the markets.

The locations in Manhattan and the Bronx will naturally be immediately adjacent to proposed terminals of the automatic-electric system. Cars laden with market stuff can be received at and forwarded from these latter terminals, reaching and leaving the market terminals via elevators, tractors and trailers and overhead bridges, or, if service can be accepted during off hours, the market terminals can have direct connection with the tracks of the automatic-electric system. Suitable sites having been chosen in other communities, rail access for standard-equipment cars from all railroads can readily be obtained.

Commodities can be retained in the containers into which they are loaded at the receiving stations until they are delivered to drays at the market terminals. This elimination of the physical separation of points of receipt, display and storage will do away with much trucking through the streets and the resultant congestion, spoiling of foodstuffs and unnecessary costs to the community. The type of terminal market suggested, together with the automatic-electric system of transportation, will practically eliminate inter-market trucking.

The market terminals will serve as distribution centers in their respective localities for the final distribution of all classes of perishable commodities. On the most nominal rental basis, the revenues to be derived from the rental spaces therein for conducting commercial transactions for storage and other functions and service that will be afforded will more than pay the cost of operation and the fixed charges, such as interest on investment, taxes and amortization.

As the market terminal structures will presumably be similar in design to the automatic-electric terminals, it is proposed that during the evolutionary period necessary to bring about a complete reorganization of the present market facilities use be made of such of the automatic-electric terminals as may be found necessary to serve the needs of the situation. It will be entirely practicable to utilize one or more of the terminals proposed for the lower West Side of Manhattan in the vicinity of the present primary market district; also to make use for such purpose of one each of the terminals proposed for the lower East Side of Manhattan, Harlem and the Bronx. Gradually the dealers in the present markets will presumably find it advantageous to relocate in the market terminals to be provided when the occasion demands, but this will not be compulsory; they can remain in business at their present quarters with facilities superior to those they now enjoy for receiving their goods.

Transportation from Receiving Stations to Market Terminals

Little more need be said as to the transportation between the receiving stations and the market terminals. As previously stated, that to the terminals in Manhattan and the Bronx will be effected by the automatic-electric system; that to other parts of the Port District by trap cars of standard equipment handled by ordinary locomotives. The main point is that the great bulk of the work now done by trucks on the streets will be done by railroad cars running underground or on private rights-of-way over much more direct routes and in much shorter time than can be accomplished by the trucks.

It should be borne in mind that New Jersey will be benefited as fully as New York by the system. The primary market will probably remain in lower Manhattan, where economic necessity has established it; but goods bought by New Jersey dealers from samples at the primary markets will be delivered direct from the New Jersey receiving station, eliminating the double trip across the Hudson River.

Receiving Stations for Water-Borne Foodstuffs

Receiving stations for water-borne foodstuffs can be created over certain piers, and service between them and the markets can be provided when desirable by trucks carrying refrigerated containers. If one of the market terminals is near at hand and the business warrants, street congestion can be avoided through the construction of overhead or underground connections, similar to those suggested to connect the automatic-electric stations with the market terminals.

Milk

One highly important commodity that is now handled independently can be brought in to great advantage over the system suggested. This commodity is milk.

At present the New Jersey railroads bring to the Port District annually about 610,000 tons of milk, and the New York railroads about 165,000 tons. All milk received by the New Jersey railroads except a comparatively small amount which the Pennsylvania delivers in Brooklyn is delivered at milk platforms in the several railroad terminals along the New Jersey waterfront. Ninety per cent of this amount is trucked from the New Jersey side to the several pasteurization and distribution plants located throughout the different boroughs of the City of New York, and the balance is consigned to the various New Jersey communities. With respect to New York's supply the present method of distribution is not only unduly expensive, but also uncertain, as it is necessary to depend on the ferries for transportation across the river, which service is subject to interruption by fog, ice or strikes.

Under the proposed plan for receiving and distributing perishable foods, milk trains will be received at the joint yards and the cars switched to tracks at the transfer platforms, where the containers and cases will be removed from the railroad cars and transferred to containers properly cooled and iced when the season requires it. The containers will be designed for use on truck chassis, to which they will be transferred from the automatic-electric cars on arrival at the terminal on the New York side, and thus they will be transported to pasteurizing and bottling plants.

Dressed Meats

Dressed meats come in the same category as milk, in that, although they are now handled independently of the primary market by a few large dealers, the system proposed is well adapted to this trade. The meats can be transferred without material change of temperature from the standard cars to refrigerated automatic-electric trailers or truck bodies and delivered to all parts of Manhattan, while more ample space for cold storage is available at the receiving stations than the majority of the dealers now enjoy in Manhattan or the Bronx.

The Commission had dressed meats particularly in mind when it suggested on page 260 the possibility of stations for the direct receipt during off hours of trailer-bearing automatic-electric cars.

Fish

Fish presents a somewhat different problem from other commodities, inasmuch as very little fish is handled in the freight cars. Ultimately it is probable that a way can be found to include fish in the comprehensive market system proposed. For the present it will presumably continue to be handled at its separate wholesale market. A receiving station in the Bronx after the order of those proposed for other foods and embraced in the public inspection service would eliminate a considerable amount of double trucking, to the Fulton Market and back to the Bronx, of fish brought from New England by the New York, New Haven & Hartford Railroad.

A public fish pier would also doubtless stimulate the direct delivery of sea fish by fishing vessels. There is at present a surprisingly small amount of such fish so delivered at the Port. The entire fish market is overcrowded, and more space is needed to afford the dealers' employees an opportunity to handle the fish in a more careful and sanitary manner. Refrigerating facilities immediately adjacent to the market, to eliminate the present trucking, are much needed.

Service for the Local Farmer

The foregoing plan makes no special provision for the local farmer. The Commission believes provision should be made, to relieve him of the necessity of trucking his wares from 30 to 50 miles to the farmers' markets in the Port District and then losing additional time marketing them — time that he needs on his farm, looking after his prime business of producing.

While the Commission does not possess data showing what proportion of the Port's foodstuffs is grown within trucking range of the Port District, the volume is unquestionably large in season. The goods are almost invariably marketed by the grower or producer, who must thereby attempt to combine producing, transporting and merchandising — a thing practically impossible of accomplishment with paying results. The average farmer produces on so small a scale that he can ill afford to take himself from the producing end to make the trips to market; yet he does it because he ordinarily has no alternative.

The business of marketing local farm products is almost wholly unorganized. Little or no attempt is made at grading or standardizing of packing. There has been little development of co-operative associations. Recently, with the employment of the motor truck as a transportation agency, some of the more enterprising growers have begun to buy products from their neighbors and truck these purchases as well as their own products to market in single consignments. It is reported, also, that in some districts motor-truck express lines are being operated for the benefit of the growers, small lots from a number of farmers being consolidated and consigned to a dealer or commission merchant.

The Commission feels that an extension of endeavor along these lines is desirable to relieve the producer of the duty of transporting and selling. It is suggested consideration be given to a plan whereby stations be established in producing areas for the assembling and grading of farm products. These stations could well be located within such distance of the principal markets of the Port that an average of two round trips with a motor truck could be made daily to any one of them from the station. To make this possible the receiving stations would be placed within a zone created so as to include all territory within a radius of 30 miles from Manhattan. Also, it would be the purpose so to locate the stations that the farmer's haul thereto would not exceed an average of five miles.

Under one plan of operation the farmer would deliver his produce at the receiving station, where it would be combined with other lots, properly graded and packed, receipt being given therefor, after which it would be transported to the principal market centers by motor trucks.

The advantage to the farmer is that instead of being away from his farm anywhere from four to eight hours, as at present, he would be able to truck his stuff to the nearest receiving station and get back to the farm within a period of two hours. The joint advantages to the farmer and the dweller of the urban communities are manifest. With cool storage at receiving stations and quick runs to the markets, the urban dweller would be receiving strictly fresh vegetables for his table and the truck farmer would be able to command a higher price for his goods, because of their freshness. The consolidation of all of this business would make such a respectable tonnage that it would be worth while for any organization to handle it, and it could not be so successfully subordinated to farm produce coming by rail from distant points.

Perishable produce from southern New Jersey labors under a considerable disadvantage in that it is difficult to obtain cars in which to ship it. The Commission believes that a boat service from the southern part of the State to a pier conveniently located within the Port District, with motor distribution from that pier to markets of the urban communities of New York and New Jersey within the Port District, would be a desirable extension to this system of receiving stations for farm products.

To carry out the plan of operation there necessarily would have to be liberal co-operation and possibly a public or quasi-public organization to perform the duties of receiver, carrier and distributer.

Plan of Commissioner of Markets

Recently the Commissioner of Markets of New York City has made public a plan for two elaborate market terminals to serve the city — one for Manhattan on the Hudson River waterfront at the site of the present West Washington Market, the other for Brooklyn on the site of the city's market property on the waterfront just north of the Thirty-ninth Street ferry house. Each plan provides a pier or piers for ships and barges, and rail service through float bridges. Wholesale stores, farmers' markets, retail markets, poultry and fish markets, and warehouses are also provided.

In the Commission's estimation the plan for the Manhattan market terminal represents an undesirable use of the waterfront, perpetuating railroad occupancy, intensive rail operations at grade on the Marginal Way and other evils the Commission believes should be abolished. The terminal for South Brooklyn if built would cut off the rail access required for the United States Navy Base, and would also if built at once block the way to the waterfront railroad the Commission's comprehensive plan shows. The Commission is therefore unable to endorse the market plan.

Conclusion

The changes proposed by the Commission for the distribution of foodstuffs, while sweeping in their character, are evolutionary and not revolutionary. No dealer is summarily put out of business, none is forcibly transplanted. The plan simply provides each dealer all along the line with better facilities for doing business, and brings about a co-ordination more in keeping with the needs of the situation.

CHAPTER 21

Reorganization of Manhattan's Hudson River Waterfront

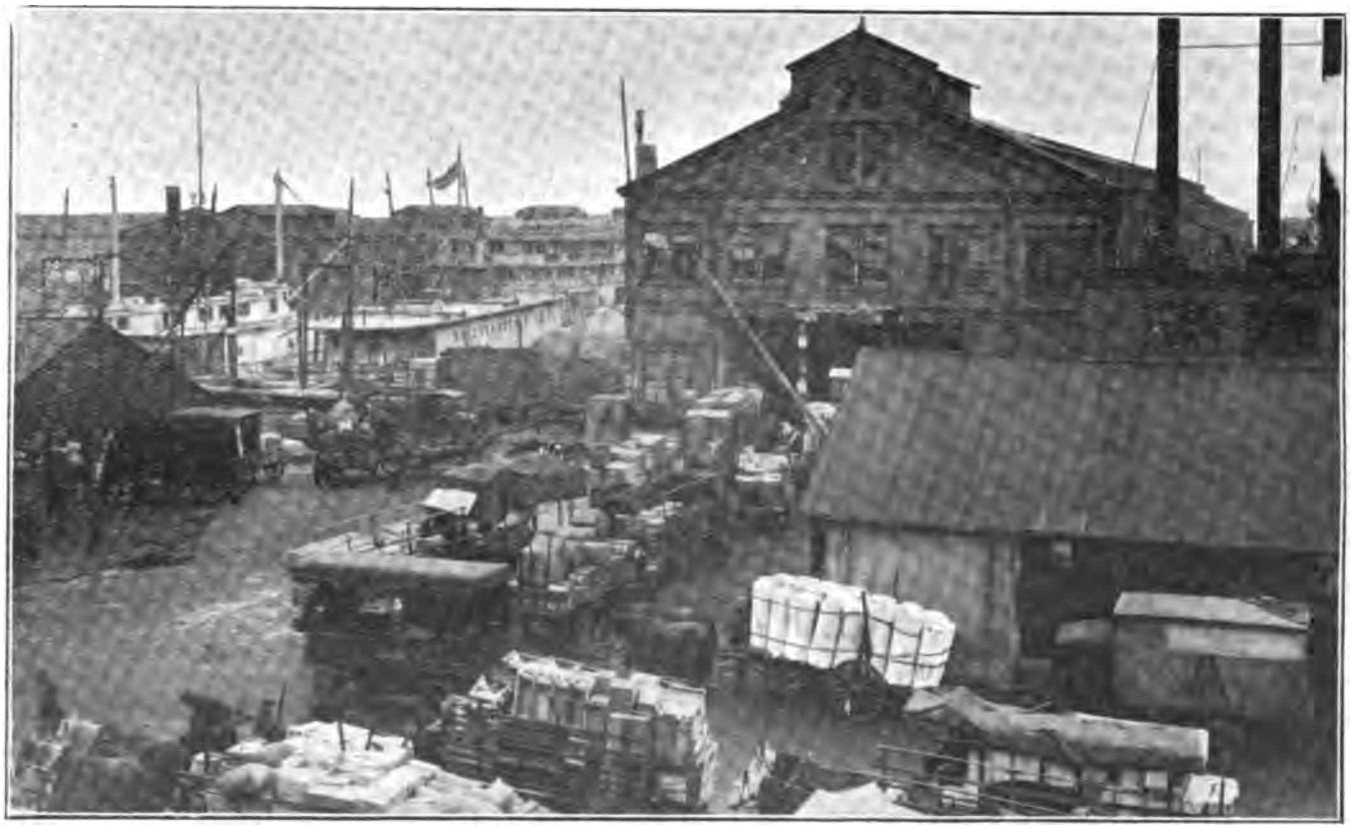
One of the material benefits of the automatic-electric system recommended by the Commission is the release of waterfront property occupied by the railroads. Apart from the direct advantage of making this waterfront available for shipping, which cannot use the interior as the railroads can, this removal of the railroads will make simple what, though much needed, would otherwise be very difficult to accomplish — a complete reorganization of the west waterfront of Manhattan, a substitution of piers built to serve the steamships of 1925 and 1950 for those designed for the sailing craft and small steamships of 1875. Manhattan's piers are mostly relics of a departed age. Whether or not Manhattan needs cranes and other freight-handling machinery on her piers, it is certain that aside from a small number of comparatively new structures, she needs quite a different type of pier from those she now possesses.

When it became apparent that the railroad piers could be released, the Commission's engineers began a study for reorganizing the entire commercially developed waterfront from Battery Place to Fifty-ninth Street. Meanwhile the Department of Docks of the City of New York, equally aware of the obsolescence of most of the Manhattan piers, had been making studies, and on July 29, 1920, a plan prepared by the department for a new layout from Fulton to Perry Street was adopted by the Sinking Fund Commission.

The studies of the Department of Docks have been continued to Seventy-second Street, but the submission of a formal plan is awaiting the decision of the United States War Department on an application to extend the pierhead line. The Commission, in order not to delay its report, has been compelled to proceed without awaiting that decision.

The Commission and the Department of Docks had arrived independently at certain basic principles, that most of the existing piers should be replaced with a smaller number of wider piers, double-decked and extending in all cases to the pierhead line, and with wider piers; that multiple-story warehouses should be constructed along the bulkhead, on the Marginal Way; that freight driveways should be provided at both pier-deck levels, and that a continuous elevated esplanade for passenger vehicles and pedestrians should be provided. Such construction on the Marginal Way was made possible by Chapter 809 of the Laws of New York, 1920.

The Commission's plan and the official plan differed as to the precise location of the piers, but there was no material difference as to their dimensions. The plan the Commission presents in Fig. 12, Part IV, and in Figs. 1 and 2 in this chapter is a composite plan, showing the pier locations of the official plan within the limits of that plan — namely, from Fulton to Perry Street — and pier dimensions compatible with it south of Fulton Street and north of Perry Street, together with a Marginal Way development throughout that seems to the Commission most likely to eliminate congestion and facilitate cargo transfer. The plan is a suggested plan and is not included in the comprehensive plan recommended for formal adoption.



Typical View of Present Conditions on Manhattan's Hudson River Waterfront — Drays in Line at Steamship Pier — Awning Shed in Right Foreground — Open Bulkhead and Ice Bridge on Left

Tailboard and tractor-trailer service would help here.

Details of a pier design deemed by the Commission desirable for this waterfront are presented in Type I of "Suggested Plans," Chapter 23, page 356.

NUMBER AND DIMENSION OF PIERS

Under the composite plan, taking into account the existing piers that would remain unchanged, there would be 71 piers north of Pier A instead of 97 as at present. Fig. 12, Part IV, shows the changes proposed and shows for comparison the existing layout. Beginning at Pier 15, Vesey Street, the plan contemplates reconstructing all piers from that point north to Fifty-ninth Street except the five piers, Nos. 48 to 52, known as the Southern Pacific piers; the eight Chelsea piers, Nos. 54 to 62, the 1,000-ft. pier at West Forty-sixth Street, Piers 93-98 from Fifty-third to Fifty-eighth Street inclusive, and possibly one or two others. It will thus be seen that there are more modern piers north of Perry Street than there are old piers to be reconstructed.

The new piers, if the plan is carried out, will be built uniformly to the pierhead line, giving piers 1,000 ft. or more in length in the vicinity of Canal Street, and somewhat shorter ones farther north and south. The piers will be from 125 to 175 ft. wide and the slips from 250 to 360 ft. wide, the greater width bearing a general relation to the greater lengths.

In the section covered by the city's plan the relocation of the piers extends north and south from the established location at Canal Street of the vehicular tunnel now being built. One of the new piers will be placed over the tunnel to protect it against possible damage, and to provide for a ventilation shaft at the end of the pier.

One of the outstanding features of the city's plan is the ultimate elimination of the Barclay, Chambers, Desbrosses and Christopher Street ferries. This does not mean that nothing can be done on the plan until the ferries are removed, or that the Department of Docks expects an early discontinuance of ferry service. The department's theory is that the piers between existing ferries can be built at once or whenever the expiration of leases and the governing conditions make it desirable, the gaps left by the ferries to be filled by piers of the same type at whatever time the ferries are abandoned. The underlying thought is that the need for ferries will ultimately disappear with the construction of vehicular and passenger tunnels.

The majority opinion of the Commission, for reasons set forth on pages 329 and 330 of Chapter 19 on "Ferries and Vehicular Tunnels," is that the discontinuance of none of these ferries is to be expected for many years to come. Inasmuch, however, as the widths of the ferry slips bear no relation to desirable widths of a modern pier and slip, it would be impossible to devise a layout that would be equally economical of space before and after the ferries were eliminated. A choice had to be made, and the city has chosen a plan which will be best if and when the ferries are discontinued.

PRESENT CONGESTION

As previously stated, all of the new piers will be double-decked. The majority of the existing piers are single-decked, and even in the case of the double-decked piers the second decks, while in some instances intensively used in passenger service, are utilized only to a very limited extent in the handling of cargo for the reason that they are inaccessible to drays. Consequently all freight is handled over the same floor, and the necessity for maintaining a driveway on the narrow pier greatly limits the space available for temporary storage. Goods have to be tiered high and sorted and resorted, and at many of the piers the congestion is far worse than at any railroad pier station, trucks frequently remaining in line all night to get or deliver their freight.

Almost continuously from Pier 1 at Battery Place to Pier 52 at the foot of Gansevoort Street there exists a headhouse or bulkhead shed connecting the inshore ends of the pier sheds. The railroad companies use their bulkhead sheds as outbound freight houses and so fairly effectively separate inbound and outbound freight. The steamship companies in general use them merely to house steam plants, supplies and offices, and for miscellaneous storage, so that they afford practically no support for the piers.

The wide Marginal Way alongside West Street and the other waterfront thoroughfares to the north, although an excellent conception, has not been effectively used. The bulkhead sheds, while encroaching on the Marginal Way, are not wide enough to be of great service. The Way is further narrowed by the awning sheds in front of a number of the piers, and by the widespread use of the Way for open storage, while freight trains and standing cars in West Street offer further impediments. The result is a paved way of variable widths, over which the truck lines spread in haphazard fashion. The Commission proposes that the roadway proper be narrowed uniformly, but that the awning sheds and steam railroad tracks be removed, and that auxiliary driveways be provided in the headhouse structure itself, not only at the ground level but at two upper levels. The aggregate width of driveway will be materially increased, and the truck lines more easily controlled, while at the same time needed support for the piers in the way of bulkhead sheds will be provided.

PROPOSED LAYOUT OF HEADHOUSE

The plan indicates the headhouse and bulkhead shed extending almost continuously from Pier 10 to Fifty-ninth Street, exceptions occurring at such points as ferry entrances and piers for special uses where a typical headhouse is unnecessary or inadvisable. The typical headhouse would be 140 ft. wide and would be located as near as practicable to the bulkhead wall. It would have three floors throughout for a width of 60 ft. on the outshore or western side, and from three to ten stories throughout the remaining width of 80 ft., according to the particular needs of the locality and the ability of the material under the Marginal Way to carry the loads. The second floor of the headhouse would be about the level of the second deck of the pier, and directly connected thereto.

In the lowest or ground floor, according to the plan, is a driveway parallel with West Street and separated from it only by a row of columns under the eastern or inshore face of the structure. This driveway is about 40 ft. wide, and along most of its western or outshore side extends a platform which is at tailboard height above the street. Easy access is provided from all points of this platform to the lower pier deck. On the second floor a driveway and a loading platform are located immediately above those on the ground floor. Ramps leading from the street level to the second floor occur at intervals of from 900 to 2,000 ft., these furnishing access for drays and trucks in going from street grade to the second-floor platforms and exits for drays and trucks returning.

The second-floor driveway is continued throughout from Battery Place to Fifty-ninth Street, with provision that connections may be made between it and the second decks of any of the newer existing pier sheds as may be deemed advisable in each particular case, even though the plan of operation of the headhouse system does not require an absolute continuity of driveway.

UPPER STORIES AND ESPLANADE

Above the second floor and its driveway is a warehouse floor the full width of the structure, and above this third floor the treatment will depend upon the requirements of the trade served by the particular pier. In any event an esplanade 60 ft. wide will be carried continuously along the outshore face of the structure, giving both pedestrians and passengers in pleasure vehicles a full view of the river. Where the trade warrants it and the foundation conditions will permit, the shed is to be continued upward along the inner 80 ft. to a probable maximum of ten stories. Where it is not desired to carry the warehouse above the esplanade level the latter will be widened out into a plaza or playground, utilizing the entire 140 ft. of width.

Thus the proposed structure, modified at points to conform to the irregularity of the existing bulkhead line, consists essentially of a continuous building 140 ft. wide, with 40-ft. driveways set into it at the first and second floor levels on the inshore side, and a 60-ft. open driveway next to the water at the fourth-floor level. The structure at once gives the public access now denied it to the beauties of the river, affords it a thoroughfare for pleasure vehicles, and provides a means of operating the piers efficiently, as will be described.

OPERATION OF FACILITIES

In ordinary operation inbound and outbound cargo will be handled on separate decks, inbound at the second-story level and outbound at the ground level. Truckmen calling for freight will not as at present drive upon the pier and impede traffic while they hunt for their goods in the deep piles of freight. They will back to berths in the sawtooth platform on the second story of the bulkhead shed and there await their consignments, which will be brought to them by tractors and trailers. A small opening through the platform will be left to permit them to drive upon the pier to get pieces too large or heavy for the trailers, but otherwise the drays will be excluded from the piers. Such exclusion of the drays and the assignment of an entire deck of the pier to inbound cargo, together with the storage facilities provided in the headhouse, will make it possible to spread the goods out and make them accessible without the repeated rehandling necessary at the present time.

Goods not called for within the free limit will be taken by elevators to one of the warehouse floors of the bulkhead shed. Keen competition and the lack of storage space near at hand combine at the present time to impel the steamship companies to disregard their rules regarding free storage. The easy means the Commission proposes for providing for the removal of the goods will tend to put a stop to the abuse of the storage privilege by consignees, inasmuch as a storage charge can and should be made for goods carried to the upper floors of the bulkhead shed.

Outbound goods will ordinarily be handled at the ground floor level, the drays backing to the platforms and tractors and trailers handling the goods to the pier. Openings will also be provided at this level to permit drays with heavy or large pieces to run upon the pier. The elevators leading to the storage floors will come down to this floor, so that goods brought to the pier too far in advance of the time for loading upon the ship can be taken into storage.

This separation of inbound and outbound cargo by floors need not be inflexible, inasmuch as a preponderance of cargo in either direction may make it desirable to vary the scheme of operation as can easily be done. The purpose of the plan is to make the pier what it should be — a transit shed and not a warehouse.

DRIVEWAYS AND RAMPS

One-way truck traffic is contemplated in the driveways along the platform. Drays bringing freight will enter from West Street at a point north of the unloading platform and will depart at a point south thereof. Drays coming for freight will run upon the second-story driveway from a ramp north of the platform and depart by a ramp south of it, the ramp being wide enough for traffic in both directions.

Ramps are shown on the map by way of suggestion. The Commission believes that the number and spacing of them is about correct, but assumes that the precise locations are matters for future determination. It seems desirable to run them approximately at right angles to the waterfront, with the approaches on Greenwich Street, to get the drays well away from the vehicular traffic on West Street.

A smaller number of ramps to the esplanade, also on merely tentative locations, are shown. Because of their greater length they will probably have to be in West Street, parallel and adjacent to the second-story driveway of the headhouse. They lead, however, from the lateral ramps, as it is not intended to permit the passenger vehicles which will use the esplanade to run on the second-story driveway.

Provision is made at the ferries, where there will be no need for the bulkhead warehouses, to widen the esplanade to the full width of the headhouse structure to provide space for parking vehicles. Provision is also made for a plaza above the parking space with a bridge and stairway connection to the esplanade sidewalk.

PIECEMEAL CONSTRUCTION FEASIBLE

Although the proposed plan is shown on the map in its entirety, it is possible to carry the changes out in small sections as may be made possible or desirable by the expiration of pier leases or by other considerations. On account of the limited width of the driveway on the second floor of the headhouse, necessitating a one-way movement, any piers built according to the new plan will require an approach ramp at each end of the section. This does not necessarily mean that the headhouse and piers must be complete for the entire distance between such ramps, for the reason that it will be possible to extend the second-floor driveway by itself some distance in the Marginal Way to effect a junction with a ramp approach.

Obviously no great use can be made of the esplanade by vehicles until a considerable part of it has been opened for traffic, but at many points it would be feasible to fill in such gaps by simply constructing the connecting esplanade and building the headhouse under and beside it at a later time. Meanwhile any short section of the esplanade would be highly beneficial for recreation purposes.

The Commission has analyzed the traffic on West Street at the present time and that to be expected after the elimination of the railroad pier stations, and is convinced that the eight truck lines provided for on West Street and the Marginal Way will accommodate all of the truck traffic likely to use the thoroughfare.

Conclusion

The two principal objectives of the Commission in its suggested layout were increased tailboard space and increased supporting storage. It obtains the former by utilizing the full length of the bulkhead at two levels; the latter by warehouse floors along the Marginal Way. At the same time the greater length and width of piers and slips and the provision of double-decked piers should go far toward promoting rapid discharging and loading of vessels and reduction in the ship's lay period. The saving in cargo-handling and trucking costs is the economic justification of the plan, which can be carried out at whatever time the traffic warrants it.

The esplanade is not an essential feature of the plan. It is offered as an opportunity for the city to acquire at relatively small expense an unobstructed thoroughfare for passenger vehicles through lower Manhattan, and a much-needed breathing space for the public.

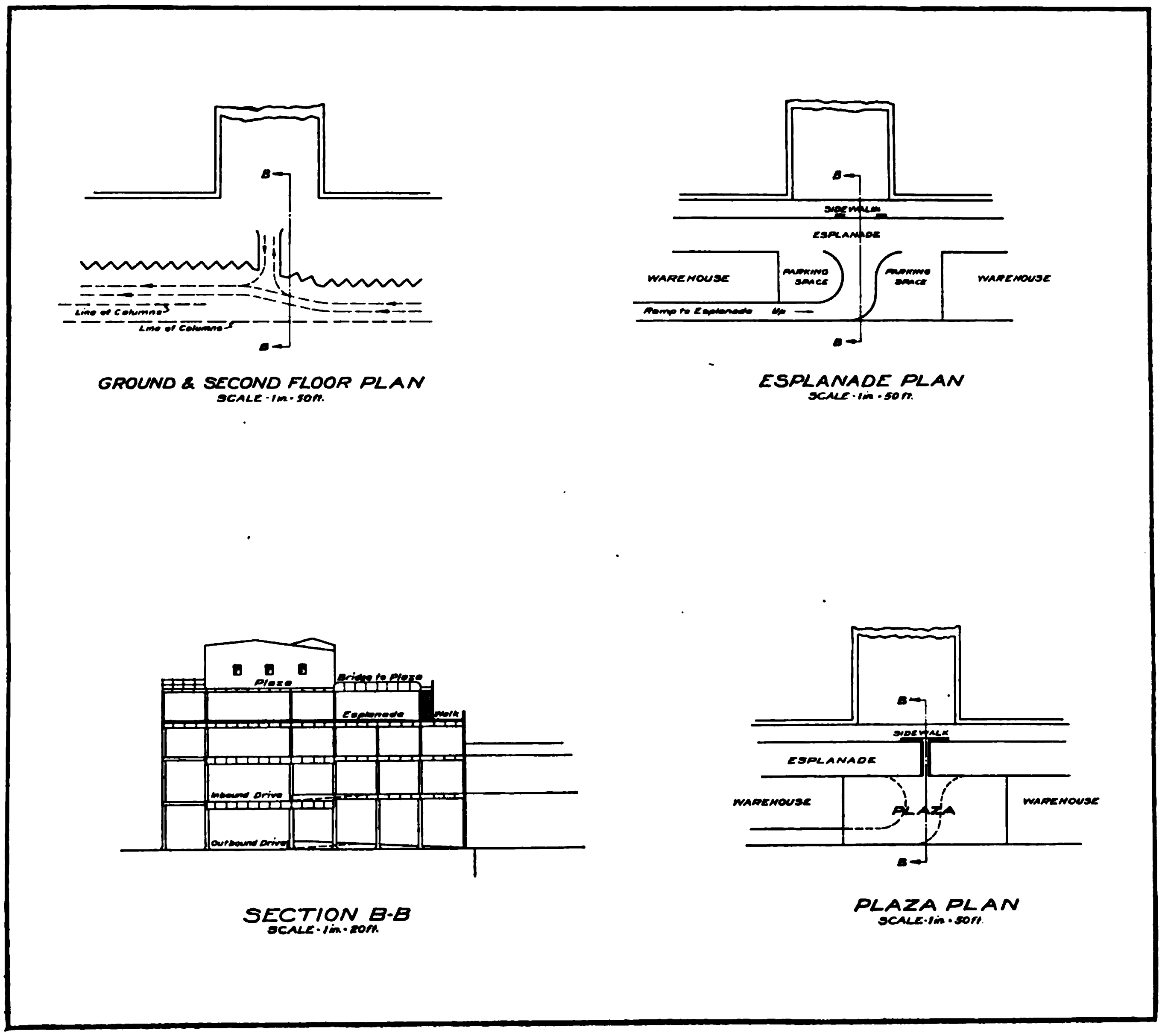


Fig. 1 — Plans and Section of Suggested Warehouse Structure and Esplanade — See Fig. 12, Part IV, for Locations of Sections

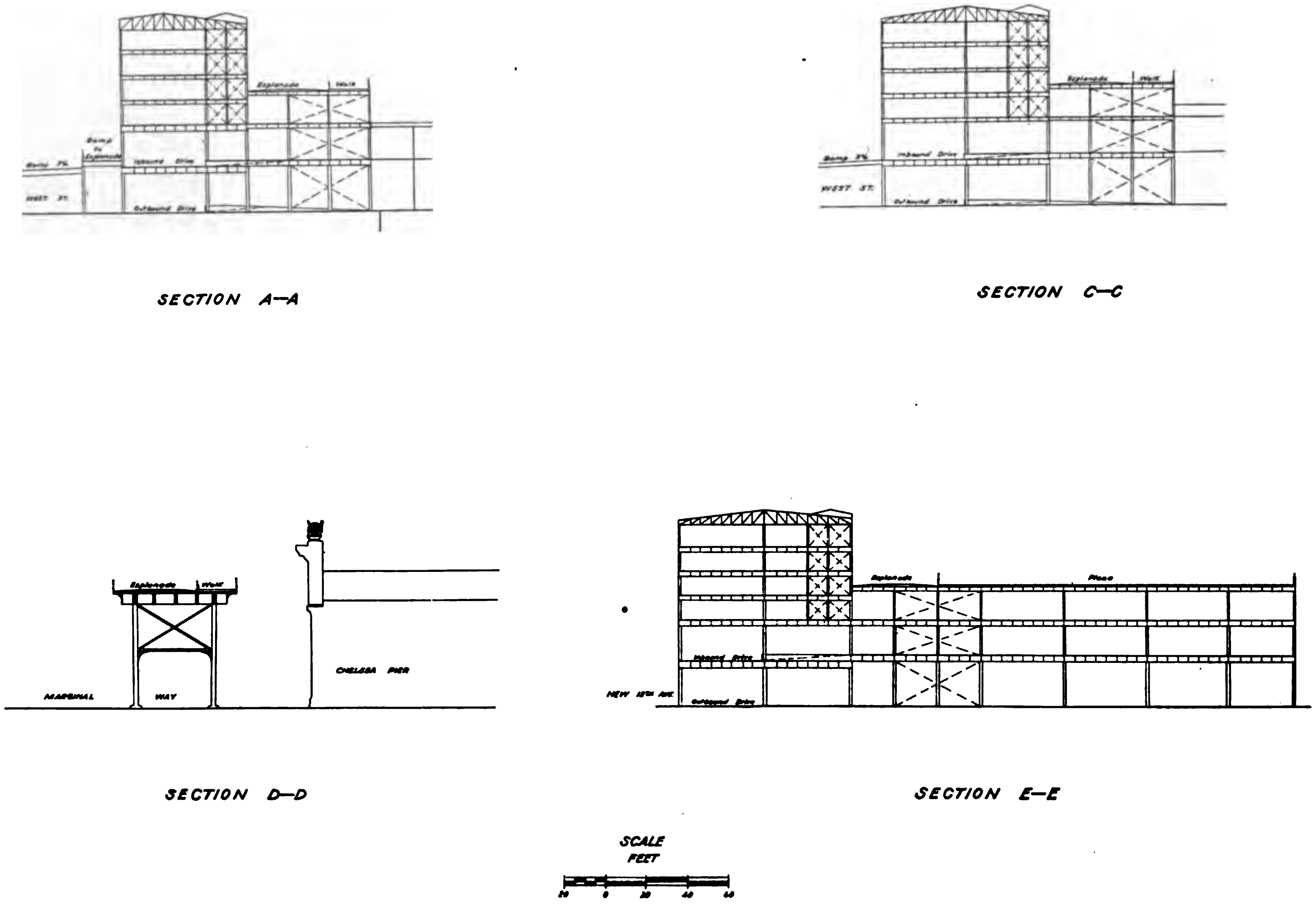


Fig. 2 — Transverse Sections of Suggested Warehouse Structure and Esplanade — See Fig. 12, Part IV, for Location of Sections

CHAPTER 22

Potential Reorganization of New Jersey's Hudson River Waterfront

Before any effective reorganization of New Jersey's Hudson River waterfront can be brought about, it will be necessary to reduce radically the present shore-front occupancy of the New Jersey railroads.

We have already seen in Chapter 16 on "Belt Lines and Consolidated Marine Service" that the automatic-electric system, belt lines, joint car-float and joint lighterage stations would eliminate approximately 37 per cent of the tonnage passing through the waterfront yards of the New Jersey railroads and that an additional 13 per cent of such tonnage need not use that waterfront.

A detailed analysis of the New Jersey railroads' waterfront facilities shows that the elimination of the sections at present devoted to lighterage and car-float service would reduce their waterfront occupancy about 47 per cent. If to this 47 per cent is added 3 per cent of the railroad shore front already occupied by steamship facilities and 24 per cent which is as yet undeveloped for railroad purposes, it is apparent that approximately 74 per cent of the railroad occupancy between the Standard Oil Company's property at Bayonne and the south end of the Palisades Park Reservation at Fort Lee has possibilities for commercial usage.

PRESENT AND POTENTIAL WATERFRONT OCCUPANCY

Of the 13.9 miles of shore front from Bayonne to Fort Lee, 7.27 miles are controlled by the New Jersey railroads — 1.79 miles undeveloped and 5.48 developed. Hence the 74 per cent of railroad occupancy that can be made available for commercial purposes is equivalent to about 5.39 miles or 39 per cent of the entire waterfront between the specified limits.

Eliminating the frontage devoted to lighters, car floats and steamship service from the 7.27 miles leaves 1.88 miles of shore front in railroad service, of which 0.58 mile is in passenger and ferry service and 1.30 miles are necessary for the handling of coal, grain and live stock. The Commission does not recommend for the present any change in the occupancy of this 1.88 miles.

New Jersey Shore, Hudson River — Occupation by Piers and Float Bridges in Lighterage and Car-Float Service

Of the remaining shore front 0.98 mile is undeveloped and suitable for industrial uses, 2.20 miles are already highly developed industrially, 0.11 mile is in ferry service other than that operated by the railroads, 1.22 miles are occupied by steamship companies or closely allied interests, 1.42 miles are undeveloped and suitable for steamship occupation, 0.67 mile is in course of development for steamship usage, and 0.03 mile, owned by a municipality, is devoted to marine service.

Summarizing, we have the following present control of the Hudson River and Upper Bay waterfront from Bayonne to Fort Lee

Controlled by	Miles	Per cent
Railroads	7.27	52.30
Steamships	1.89	13.59
Various interests	4.69	33.75
Municipalities	0.05	0.36
	13.90	100.00

as compared with a potential use as follows:

Use	Miles	Per cent
Commerce	8.73	62.80
Industry	3.18	22.88
Passenger and ferry service	0.69	4.97
Railroad coal, grain and live stock	1.30	9.35
	13.90	100.00

The present control of this 13.9 miles of waterfront is presented in more detail in Table 1 and the occupancy made possible by the automatic-electric system, belt lines and consolidated rail and marine service in Table 2.

REORGANIZATION ON A BROAD SCALE

With such an amount of waterfront released to commercial use the Commission believes that upon the

Land Entrance to Waterfront Yard in New Jersey — Background of Picture Shows Shore Occupation by Lighterage Piers, Float Bridges and Coal and Grain Handling Facilities

adoption of its recommendations it will be possible to start planning for its development as a whole and to plan and construct steamship units fully in harmony with the ultimate plan.

It is quite possible that further analysis may show it to be necessary to devote some part of the reorganized waterfront to a canal to serve lighterage and car-float stations located on undeveloped uplands remote from the commercial front, but this at the worst would not reduce the frontage available for commerce and industry by more than six-tenths of one per cent.

Several such locations for these stations are possible, and it is not impossible that the Hackensack Meadows, with a canal from the Hudson River through Bergen Hill for lighters and car floats, may prove to be a practicable site.

Table 1 — Present Control in Miles of Hudson River and Upper Bay Shores from Standard Oil Company's Property at Bayonne to Palisades Park Reservation at Fort Lee

Municipality	Control Railroads	Steamships	Municipal	Various	Total
Bayonne	0.17	0.00	0.00	0.47	0.64
Jersey City	4.74	0.18	0.03	0.21	5.16
Hoboken	0.38	1.04	0.00	0.34	1.76
Weehawken	0.81	0.67	0.00	0.00	1.48
West New York	0.88	0.00	0.00	0.04	0.92
Guttenberg	0.00	0.00	0.00	0.13	0.13
North Bergen	0.00	0.00	0.00	0.73	0.73
Edgewater	0.29	0.00	0.02	2.77	3.08
Total	7.27	1.89	0.05	4.69	13.90
Per cent	52.30	13.59	0.36	33.75	100.00

Table 2 — Potential Occupancy in Miles of Hudson River and Upper Bay Shores from Standard Oil Company's Property at Bayonne to Palisades Park Reservation at Fort Lee

Municipality	Uses Railroad	Steamship	Industrial	Ferries	Total
Bayonne	0.00	0.64	0.00	0.00	0.64
Jersey City	0.86	4.00	0.00	0.30	5.16
Hoboken	0.00	1.28	0.34	0.14	1.76
Weehawken	0.00	1.37	0.00	0.11	1.48
West New York	0.22	0.63	0.04	0.03	0.92
Guttenberg	0.00	0.00	0.13	0.00	0.13
North Bergen	0.00	0.73	0.00	0.00	0.73
Edgewater	0.22	0.08	2.67	0.11	3.08
Total	1.30	8.73	3.18	0.69	13.90
Per cent	9.35	62.80	22.88	4.97	100.00

The Commission suggests Types II, III, V and IX of the suggested plans in Chapter 23 as typical steamship pier layouts which, with the necessary modifications to adapt them to the site, seem suitable for this New Jersey frontage.

All steamship piers and all industries in the reorganized waterfront will receive service from an inner belt line, composed of the various railroad shore lines which parallel the Hudson and the Upper Bay from Constable Hook to Edgewater, with the necessary connections, extensions, branches and additional tracks to make it effective. This belt line, connected with the middle, outer and all other belt lines and operated by some impartial intermediary, will give direct rail service on equal terms to ships and industries from all the railroads of the Port.

Reorganization of the waterfront along these lines will be highly beneficial to the railroads in that it will relieve them of much unremunerative lighterage service, enable them to retreat to cheaper lands for their preliminary functions and at the same time furnish them with the best market for their abandoned deep-water holdings. The induced freight will expand the railroad tonnage and it can also be handled more cheaply and expeditiously than under present conditions.

The existing tracks in those parts of the railroad waterfront yards back of the sections which it is suggested be set apart for commerce will be available to serve the steamships, piers, warehouses and industries with very little remodelling. Access to the piers, warehouses and factories by truck from the easterly side of the Hudson, which is so vital in their operation, can be had by means of existing ferries, by the vehicular tunnel or tunnels when completed, and if necessary by the creation of new lines of ferry service.

CHAPTER 23

Development of Other Sections of the Port

On page 29 of Part I the Commission has suggested briefly forms of local development suitable for various sections of the Port District. To make its suggestions clearer the Commission presents in the latter pages of the chapter nine types of development and explains the purpose of each.

In preparing this chapter the Commission has carefully considered the plans of local authorities and investigating bodies, so far as it has obtained them. It believes that nothing it suggests is in serious conflict with those plans. It has not sought to usurp the prerogatives of these local bodies, but rather to point out to them how the comprehensive plan the Commission recommends can be adapted to their needs.

Beginning at the north end of the district, passing down the east side of the Hudson River and thence crossing to the west side, the Commission attempts in this chapter to show in geographical sequence what the comprehensive railroad plan will do for each principal community, and the kind of development the location, environment, topography and other conditions suggest as most appropriate for the community.

Irvington, Dobbs Ferry and Hastings

The Hudson River waterfront communities in Westchester County, New York, although located on deep water, suffer from two disadvantages. They are overshadowed by their larger neighbor and, being outside of the lighterage limits, are served by only one railroad.

The Commission's plan offers them relief from dependence on a single railroad through a joint car-float service from the outer belt-line terminal at Piermont, New York, supplemented by short marginal or waterfront railroads in the communities themselves. Such service, which can be of substantially the same sort proposed for Brooklyn and other waterfronts, will attract industries to the waterfronts of Irvington and Dobbs Ferry, will stimulate the industries already located on the waterfront of Hastings, will attract others, and will be of great benefit to the industries and commerce of Yonkers.

Yonkers

Yonkers is by far the largest and most important community outside of New York City on the east side of the Hudson River within the Port District. It has a frontage of about 4½ miles along the Hudson River immediately north of the New York City line. Only a small part of this frontage has been developed either industrially or commercially. There are, however, a number of large and important industrial establishments in Yonkers. Some of these are located along the Hudson River, with wharf facilities on the river and side tracks from the New York Central Railroad so that they can receive raw materials and ship their finished product either by water or by rail. Others are inland along the non-navigable Sawmill River, wholly dependent for direct service on a spur from the Putnam division of the New York Central.

The Commission believes that the best use of the Yonkers waterfront will be in the extension of its industrial development. Industries which receive raw materials in ships or whose products are exported should be especially attracted by the deep water. Better highway access to the waterfront is needed, and more housing facilities for workers, but these should not be expensive to provide. Better rail facilities can be afforded, as at Irvington, Dobbs Ferry and Hastings, by a car-float service to and from Piermont.

To a large degree industrial development of this character will be by private interests, but the city should reserve one or more tracts for public terminals, to serve the establishments too small to create their own dockage facilities, and those set back from the waterfront.

As stated in Chapter 3, page 85, a combined bulkhead and pierhead line has been established in deep water along the built-up section of the city, and filling inshore of this line can be done subject to permission from the War Department. The quay type of development lends itself most readily to industrial uses and does not preclude piers at such time as they shall have become necessary.

Type IV under the head of " Suggested Plans " (page 359) is a possibility for Yonkers.

Manhattan

The Hudson River shore in Manhattan should be given over to park and recreation purposes from Spuyten Duyvil south to Seventy-second Street, except at such points as Dyckman Street, West 155th Street and Manhattanville, where the contour of the shore adapts itself to commercial usage and where perhaps Manhattan's interest will demand later development. The Commission's plan for providing freight service for Manhattan from all railroads by the automatic-electric system will make feasible the removal of the railroad tracks which mar the scenic beauties of the park.

South of Seventy-second Street Manhattan's West Side frontage is discussed in Chapter 21 — " Reorganization of Manhattan's Hudson River Waterfront."

The East and Harlem River shores in Manhattan, relieved of railroad occupancy by the automatic-electric system and provided with improved river channels will be free to develop along commercial and industrial lines in the most economic manner, and the East River shore may possibly come in time to such a reorganization as is suggested for the west waterfront.

The Bronx

The Bronx will be served along its westerly shore by an improved Harlem River and by all the railroads of the Port through the automatic-electric system and the middle belt line. Along its southerly or East River shore from the Bronx Kills to Throgs Neck an inner or waterfront belt line will provide service from all railroads to such industries and shipping as are or may be established there. These various belt lines and the automatic-electric system will provide, for years to come, the adequate freight service which the Bronx so sorely needs.

The Hudson River waterfront of the Bronx, like that of upper Manhattan, should be reserved for residential and park purposes. The ground slopes steeply and is not suited to commercial or industrial development.

BROOKLYN AND QUEENS

Service for Brooklyn and Queens is discussed at length in Chapter 15 — "Railroad Service for Long Island."

STATEN ISLAND

Staten Island is at present served directly by only one railroad, the Baltimore & Ohio. Indirectly it is served through the medium of drays, lighters and car floats by all railroads of the Port District.

Its major development is on its northerly and northeasterly shores. The lack of development of its southerly shore is attributable to two reasons. The primary reason is that it has little protection from the waves of the Atlantic; the secondary, that it lies cutside of the lighterage limits.

The westerly or Arthur Kill shore of Staten Island is undeveloped because it has no direct rail access and is outside of the lighterage limits so that freight can be handled only by lighters at a cost beyond that of its westerly neighbor, the New Jersey shore, or by drays at considerable additional expense.

The northerly or Kill van Kull-Newark Bay shore of the island is mainly occupied by the coal and other freight facilities of the Baltimore & Ohio Railroad. There are, however, developed and undeveloped stretches under private ownership.

On the northeasterly shore, at Tompkinsville and Clifton, the American Dock Company and the Pouch Terminal respectively provide berths for ships in the Eastern Ocean and Western Ocean trades, and at Stapleton the City of New York is building twelve large piers which will provide berths for forty-eight freighters with a cargo capacity of 7,500 gross tons each, or seventy-two, with a cargo capacity of 3,500 tons each, a total cargo capacity of 250,000 to 360,000 tons. Two of these piers are to be extensively equipped with gantry cranes and all are to be served direct by rail from the large yard which the city is providing. Just inshore of the piers along the marginal street the city also intends to erect on the hinterlands ample warehouses to serve the piers.

Two things are lacking for these piers — direct connection with all the railroads of the Port District, and adequate ferry service.

The Commission's plan provides for ultimate rail access for all railroads of the Port District to all shores of Staten Island by means of its belt-line system. It provides for more immediate rail access for all of these railroads to the shores within the lighterage limits by an inner or waterfront belt line served by float bridges pending the connection of all of the Staten Island inner belts with the outer belt line in New Jersey and via that belt line with all other belt lines in the Port District. The Commission recommends that additional and better ferry service be provided for the northeasterly shore of the island.

For the easterly and southerly shores of the island the Commission suggests Types II, III, V and IX of "Suggested Plans" applied in accordance with the physical and financial limitations imposed at the time of building. For the westerly shore it suggests a quay development such as is illustrated by Type IV of the suggested plans, and canalization of the marsh section as illustrated by Type VI.

PERTH AMBOY

Both the Arthur Kill and the Raritan River shores of Perth Amboy are intensively developed industrially. Many of the industries are served with raw materials direct from ships. Still further development can be accomplished along this line. For the benefit of its existing industries and to attract yet others, the Commission's plan makes possible direct service from all the railroads of the port. Perth Amboy like Yonkers should retain part of its waterfront for the benefit of its smaller industries and so administer it as to secure for them the needed rail and water service, and incidentally secure for its merchants and the general public the advantage of freight service from all roads.

For the development of such service Type IV of "Suggested Plans" is well adapted. For the city's marsh lands where canalization is possible, quay development after Types IV, V and VI is suggested.

New impetus will be given this busy and important city if the comprehensive plan is carried out.

RARITAN RIVER

Southwesterly of Perth Amboy and along the northwesterly shore of the Raritan River the Commission's plan provides for an inner or waterfront belt line. With canalization and quay development along the lines of Types IV, V and VI of "Suggested Plans" and with service from all railroads of the Port, these marsh lands will be attractive to industries importing their raw materials or exporting their products in considerable volume, and the construction will be comparatively inexpensive.

New Brunswick will derive indirect benefit from such a development and may be able under a Port Authority to carry it to its own door.

WOODBRIDGE, ROOSEVELT AND LINDEN

The westerly shore of the Arthur Kill between Perth Amboy and Elizabeth through Woodbridge, Roosevelt and Linden is intensively developed industrially. To such communities in this section as Port Reading, Chrome, Carteret, Warner and Grasselli and to the section itself the comprehensive plan will bring waterfront or inner belt lines with all the advantages of service from all railroads of the Port District. This will stimulate existing industries and bring others which require service both by rail and by water.

Canalization after Type VI of "Suggested Plans" with quay development of the waterfront as in Type IV or even Type V seems to the Commission applicable to this section of the waterfront at comparatively slight expense.

Rahway

With canalization of the Rahway River and the cooperation of a Port Authority, Rahway is within easy reach of all of the benefits of good rail and water service.

Elizabeth

On the westerly shore of the Arthur Kill in Elizabeth are located many large industries which will benefit greatly from the freight service provided for by the inner or waterfront belt line of the Commission's plan, but Elizabeth's best opportunities lie in the undeveloped marsh lands of the westerly shore of Newark Bay. Canalization in the manner of Type VI, "Suggested Plans," with quay development and service from all railroads, will provide many miles of good waterfront — industrial, commercial or both — for industries of the type attracted will bring commerce. In some sections Type IV of "Suggested Plans" will possibly prove best and later, on the bay front, Types V and IX will provide for ship terminals when needed.

On the bay the city should make reservations for warehouses and piers to serve the smaller industries.

Starting small on a well-considered and at first inexpensive plan and expanding as the business grows is the root of success for such a large development as is here possible.

Newark

Newark's Passaic River waterfront is mainly under private industrial control, and fittingly so, for Newark has long realized that the river is narrow for pier development and that her greatest opportunities lie on the westerly shore of Newark Bay. An improved Passaic River with improved rail access will do much for the river section, but the main development should and will be made on the bay section.

The Port Newark terminal zone as planned by the city has about 4,800 ft. of bay frontage measured along the bulkhead line and provides for pier lengths of 1,100 ft. Seven hundred feet of this is taken up by a canal entrance into the zone, which extends westerly from the bulkhead line approximately 14,500 feet.

About 2,600 ft. of the bay frontage and 3,000 ft. of the canal frontage is occupied by the Submarine Boat Corporation, which, during the summer of this year, in addition to its other activities, operated steamships in freight service between Cuba and Newark. More than 3,000 ft. of the canal frontage is occupied by what is known as the United States Army Supply Base, a quay development with freight sheds extending inshore and fed by drays and railroad cars on opposite sides.

This constitutes all the developed waterfront of the zone. There remains for future development under the zone plan of the city about 20,000 ft. of canal frontage and 1,500 ft. of bay front.

If the city of Newark acquires the bay front property lying between the Port Newark terminal zone and the city of Elizabeth, all of which will have direct service from all railroads of the Port when the Commission's plan is carried out, it can with the co-operation of Elizabeth open for its zone yet other canals and dispense with the turning basin which forms a requisite part of its present plan. If this should be done in accordance with Type VI of "Suggested Plans," the extended zone waterfront, direct and indirect, on Newark Bay would approximate the following figures in linear feet:

	On canals	On bay
Developed	6, 300	2, 600
Undeveloped	46, 400	3, 900
Total	52, 700	6, 500

In addition to this, there exists in Newark 7,000 ft. of bay front mainly under railroad control and some seven miles of Passaic River front under various control. For all this waterfront the quay type of development is suggested, followed where and when feasible by Types II, III, IV, V, VI or IX of "Suggested Plans" as may be most suitable. Newark should, however, reserve her bay waterfront for a pier and warehouse development to take care of the industries of the hinterlands which may need and cannot otherwise obtain such service.

Passaic

Passaic with its large population and many industries will receive benefit from an improved river, and her rail service, good already and supplemented as it will be by more facile access from other than her two rail systems, will be greatly improved.

Paterson

Paterson, a highly important industrial city, is served at present only by two railroad systems, and prospers in spite of that fact. To Paterson the Commission's plan would bring service from all rails in the Port District by way of the outer belt in New Jersey.

A branch from this outer belt down the easterly shore of the Passaic River is a possibility, and the canalization of the river up to Paterson is urged by the Commission in Chapter 24.

The Commission's plan would provide the nucleus for a larger and still more important Paterson.

Hackensack Meadow Communities

The Hackensack meadow communities — Kearny, Harrison, the Arlingtons, Kingsland, the Rutherfords, Carlstadt, Woodbridge, Hasbrouck Heights, Hackensack, Ridgefield Park, Ridgefield, Little Ferry, North Bergen and Secaucus, together with the westerly section of Jersey City, all have a large but undeveloped asset at their doors in the Hackensack and Overpeck Creek meadows. To these meadows the Commission's plan would bring waterfront belt lines with freight service from all the railroads of the Port, adequate channels in the rivers and the opportunity for a system of development unrivaled for its comparatively small initial cost and the advantages offered to industries and commerce.

Canalization of these meadows (Type VI, "Suggested Plans,"), simple quay development with transit sheds (Type IV), and the construction of piers (Types II, III, V and IX), following as the business grows, will all tend toward the formation of an auxiliary port invaluable to the City of New York as well as to the communities more directly interested.

BAYONNE

In addition to the opportunities offered to Bayonne in Chapter 32, " Potential Reorganization of New Jersey's Hudson River Waterfront," an inner or waterfront belt line on the Newark Bay frontage will serve to the advantage of the important industries already located there and will induce others. This belt will in no wise interfere with Bayonne's park system or with its logical extension for years to come.

JERSEY CITY

Jersey City, while receiving its major benefits from the possible reorganization of its Hudson River and Upper Bay waterfront, can derive more immediate benefits from the inner or waterfront belt line proposed by the Commission for its Newark Bay–Hackensack River frontage.

This belt harmonizes with the west side development proposed by Jersey City and lends additional value to the plan by providing access from all railroads of the Port District.

OTHER HUDSON RIVER COMMUNITIES IN NEW JERSEY

Hoboken, Weehawken, West New York, Guttenberg, North Bergen and Edgewater are all discussed at some length in Chapter 22, " Potential Reorganization of New Jersey's Hudson River Waterfront."

GENERAL

There is no part of the Port District that will not be benefited, directly or indirectly, if the Commission's comprehensive plan is carried out. All communities on navigable water are advised to obtain control of at least some portion of their waterfront as an invaluable future asset.

Suggested Plans

For the development of the various sections of the Port District many piers have been considered. There is no one plan which is a " sovereign specific " for all conditions and locations.

Types I to IX herein outlined are not intended to be other than illustrative, and scant attention has been given to structural details. The evils they seek to avoid are:

1. Lack of adequate transit space in the sheds, which necessitates delay to the ship or rehandling of cargo.

2. Lack of long-time storage facilities, which increases trucking costs and sometimes delays the ship.

3. Lack of direct connection with the railroads of the Port, which increases the lighterage costs to the railroads, causes rehandling of freight and often tends to delay the ship.

4. Crossing at grade or " fouling " of goods in transit between dray and ship, between car and ship and between warehouse and ship, which cause congestion, increase handling costs, and tend to delay the ship.

5. Congestion on the piers caused by the actual entrance of drays collecting or delivering freight, which, if not avoided, must be counteracted by widening the piers at costs that may be prohibitive on highly developed waterfronts, in order to obtain free passageway and yet retain sufficient transit space for the freight.

TYPE I

Type I is a sketch of a double-deck pier for the Hudson River shore of Manhattan, where railroad cars cannot economically be brought to the ship and all freight must be handled by lighter and dray. The sketch is made up to conform to the plan and the principles outlined in Chapter 21, " Reorganization of Manhattan's Hudson River Waterfront."

The upper decks of the piers are for inbound freight, the lower for outbound, although this may be reversed if the reason for so assigning them is thought insufficient by the users. This reason is that ramps from the street level to the freight driveways for the upper decks are more easily ascended by empty drays coming for inbound freight than by loaded drays bringing outbound freight.

Four ships of 3,600 tons net registry can berth at one pier, two unloading to the upper deck, two loading from the lower deck. Freight between lighters and ships is to be handled as at present. Freight between drays and ships is to be handled by tractors and trailers, inbound from the tailboard of drays at the upper-driveway bulkhead-shed platform, outbound to the tailboards of drays at the lower-driveway bulkhead-shed platform. Provision is made, however, for entrance to the pier direct from these driveways in order to accommodate such freight as is not adaptable to handling by tractor and trailer. Dray traffic on both bulkhead driveways is to be in one direction only.

Freight between the ship and the warehouse and additional transit floor space provided inshore along the bulkhead is to be handled by tractor and trailer via elevators, as is also freight between such space and drays or lighters.

The elevators shown in the plan are to be large enough to hold ten trailers, five abreast. These elevators extend only from the lower-deck level of the pier up to a working floor of the bulkhead shed immediately above the upper-deck level of the pier, and from this floor the warehouse floors of the bulkhead-shed structure are reached by smaller elevators.

The area of the pier floors plus the transit floor area of the bulkhead structure is sufficient to allow full cargoes for two ships of 3,600 tons net registry each to be assembled and at the same time provide space enough for unloading the cargoes of two similar ships. In other words, the pier floors and transit space in the bulkhead structure provide room for 30,000 tons of cargo plus the necessary aisle space for handling it.

If all drays entered the pier to receive and discharge freight as they do under the present methods, the piers would have to be built wider, or additional transit space would have to be provided within the bulkhead structure.

Type II

Type II is a plan for warehouses and piers in a location where the marginal railroad serving them is close to the bulkhead line and where land is expensive enough to warrant the building of a double-deck pier and the exclusion of drays from the pier.

The slip width between these piers should be not less than 300 ft. Each deck of the piers has sufficient width to enable it to accommodate the full cargo of two ships of 3,600 tons net registry each, with ample aisle space. The pier is long enough for berthing four such ships. The upper deck of the pier can be used for inbound cargo and the lower deck for outbound cargo, or vice versa.

Drays are not to come on the pier unless loaded with or calling for freight not adaptable to handling by tractor and trailer. For drays carrying such freight, driveways are provided along the bulkhead line down the sides and at the ends of the piers. They will enter from the ground floor through side doors, and, if destined for the second floor, will have to take the elevators.

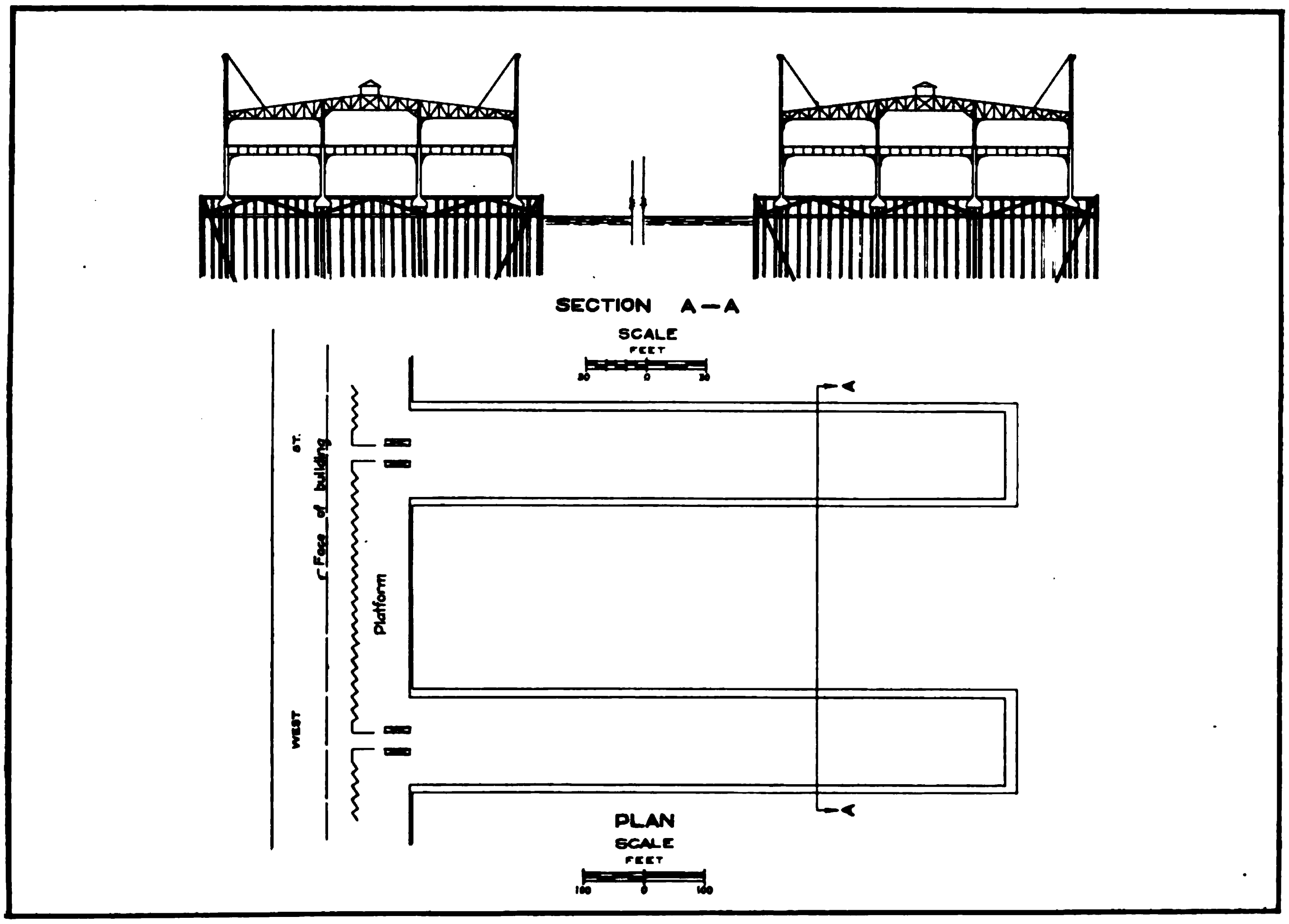
Other freight brought by dray for the lower deck of the pier is to be handled by tractors and trailers from the tailboard of the dray at the bulkhead shed platform. Freight between drays and the upper deck of the pier is to be handled by tractors and trailers from the tailboard of the dray at the warehouse platform via elevators and the overhead gallery.

Freight between car and ship on the lower deck of the pier is to be handled by tractors and trailers from the cars via elevators and the overhead passageway, and that on the second deck by tractors and trailers via the overhead gallery. Freight between warehouse and ship will be handled to the lower deck by tractors and trailers via the overhead gallery and elevators, and to the upper deck by tractors and trailers via the overhead gallery.

Betwen dray and warehouse freight will be handled by tractors and trailers from the tailboard of the dray at the warehouse platform via the elevators. Between car and warehouse it will be handled by tractors and trailers via the elevators. Between warehouse and lighters it will be handled in the same manner as freight between warehouse and ship; between ship and lighters by the method prevailing at present.

Connecting bridges between warehouses provide for the handling of freight between any ship and any warehouse of the group.

Eight of the railroad tracks shown on the plan, four on each level, with a total capacity of 65 cars, are for cars to be loaded or unloaded, as the case may be. Two on each level, with a total capacity of 34 cars, are for temporary storage purposes, and four of the tracks, the



Type I

most remote from the building, are the switching leads for the system.

There is on each level an intermediate platform between the tracks so that freight can be handled from the cars either by passing down this platform to an entrance in the building, or through previously emptied cars on the tracks nearest to the building. Freight from cars on the tracks nearest the building will be handled direct into the warehouse, which will have continuous doors at its working floors.

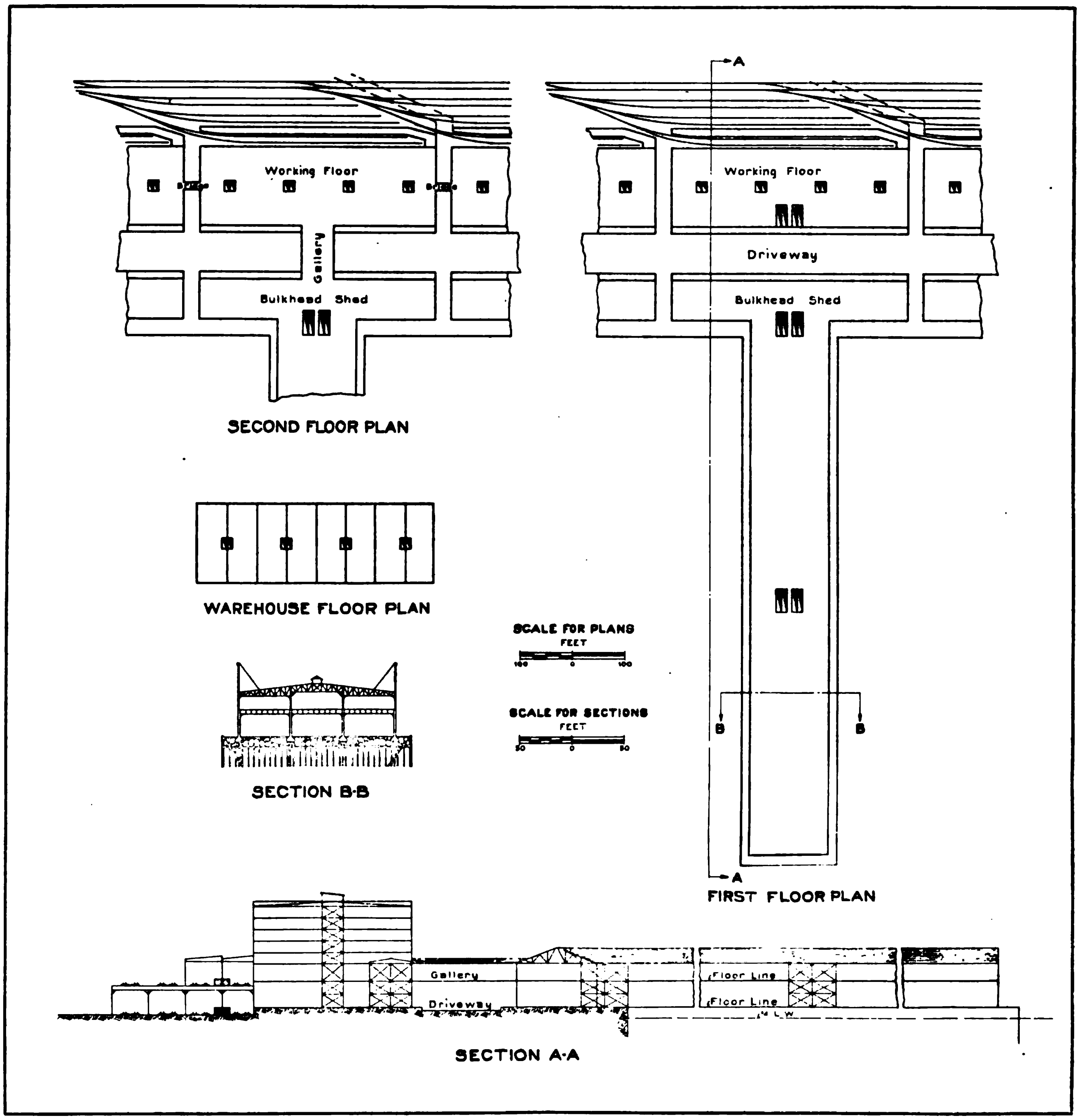
It will be noted that with this plan 50 per cent of the freight between ship and car and 50 per cent of the freight between ship and dray is handled without the use of elevators, and that all crossings at grade between drays and tractors and trailers are avoided.

TYPE III

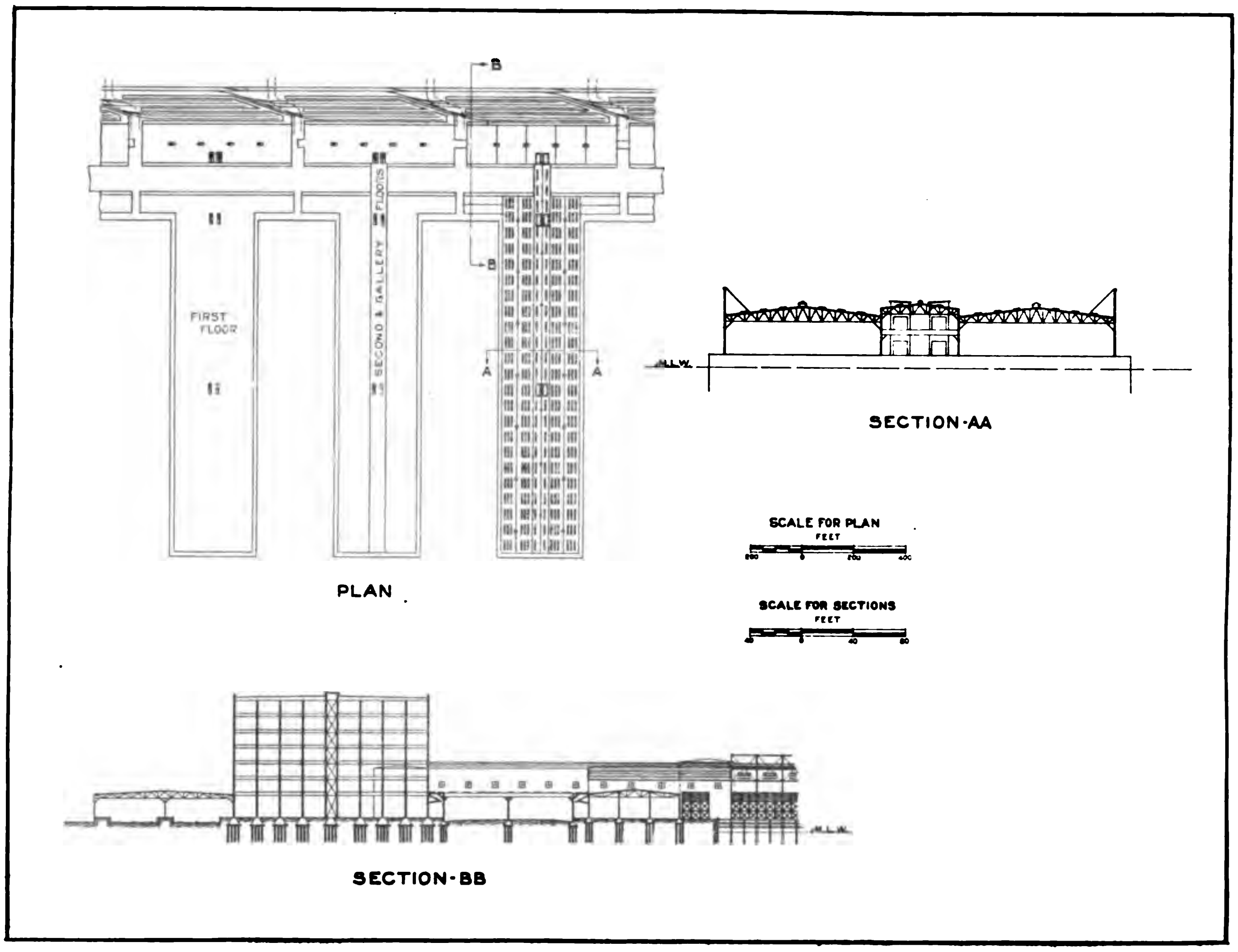
Type III is a plan for warehouses and single-deck piers where the marginal railroad is close to the bulkhead line and where the value of land is high enough to warrant the exclusion of drays from the piers.

The piers are wide enough to hold the cargo of four vessels of 3,600 tons net registry, leaving sufficient aisle space for handling, and four vessels of this capacity can also find berthing space at each pier. An overhead gallery from the warehouse down the pier is provided in each instance in order to avoid crossings at grade between drays and tractor-trailers.

Freight between dray and ship is to be handled by tractor and trailer from the tailboard platform of the



TYPE II



TYPE III

bulkhead shed. That between car and ship and that between warehouse and ship are to be handled by tractors and trailers via elevators and the overhead gallery. Freight between car and warehouse is to be handled by tractors and trailers via elevators. That between dray and warehouse is to be handled by tractors and trailers from the warehouse tailboard platform via elevators.

Freight between lighter and warehouse is to be handled in the same manner as freight between warehouse and ships. That between lighter and ship is to be handled as under the prevailing methods.

Three unloading platforms and six tracks are provided for freight between car and ship and warehouse and car. These tracks have a capacity of 66 cars.

It will be noted that freight can be taken direct from the cars via the platforms to the warehouse working floors or pass through cars previously emptied as convenience may dictate.

The two outermost tracks constitute the switching leads for the group of piers. The working floors of the warehouse are connected by overhead bridges so that freight can pass from a pier to any warehouse.

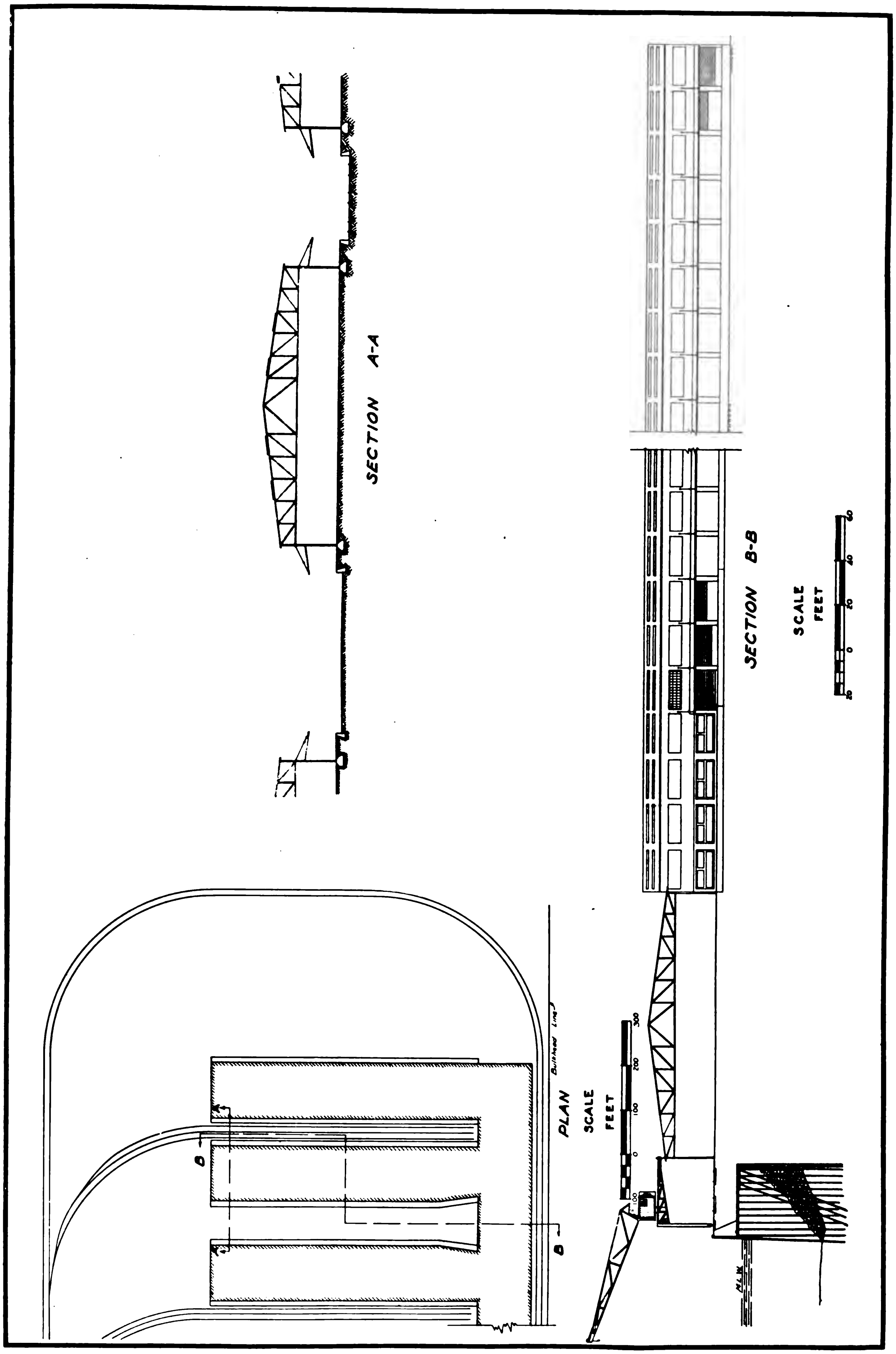
The outshore half of the pier floor is to be worked via elevators in the middle of the pier, the inshore half via the elevators at the bulkhead line. This arrangement avoids obstruction of the working space in the inshore half by tractors and trailers for the outshore half. The outshore half of the gallery is available for the storage of tractors and trailers.

The main elevators, six in all, of the warehouse and pier have a capacity of ten trailers each, five on a side. They are separated because it is thought that by running tractors and trailers between them on one route all fouling can be avoided at the elevators. The elevators between the working floors of the warehouse and warehouse floors are of a smaller size.

TYPE IV

Type IV is a quay development with a single-story bulkhead shed running parallel to the quay at sufficient distance therefrom to allow for two railroad tracks and a gantry crane.

Inshore from this bulkhead shed run single-story sheds separated from each other by alternating track and dray wells, in the manner of the Port Newark development. Each track well contains three tracks, with 12-ft. platforms alongside the sheds. The dray wells are 96 ft. wide — two 12-ft. platforms adjacent to the sheds and a 72-ft. driveway. The dray well is wider next to the bulkhead shed to provide for the turning of 5-ton motor trucks and make one-way travel possible if desired.


SECTION A-A
SECTION B-B
SCALE
FEET
20 0 20 40 60
PLAN
SCALE
FEET
100 0 100 200 300
Bulkhead Line
B
B
M.L.W.

TYPE IV

The sheds provide both storage and transit space, and all movement of freight between shed and ship is to be by tractor and trailer.

The tracks along the bulkhead and the gantry cranes are only for the handling of heavy freight between car and ship.

Type V

Type V is a suggested plan for single-deck piers and warehouses where the main railroad serving them is remote from the bulkhead line, as, for example, on the westerly side of Newark Bay or at Jamaica Bay.

The piers are of sufficient length to berth four ships of 3,600 tons net registry each, and of sufficient width to stow the cargo of four such ships, leaving room for aisle space for tractors and trailers. Two tracks for handling heavy freight between ship and car by gantry cranes run down each side of the pier outside of the shed, and three tracks for handling less heavy freight run down the center of the pier in a track well.

The warehouses will be fed from tracks at their ends, three per warehouse. Separate driveways are provided for dray service to the warehouses and to the piers.

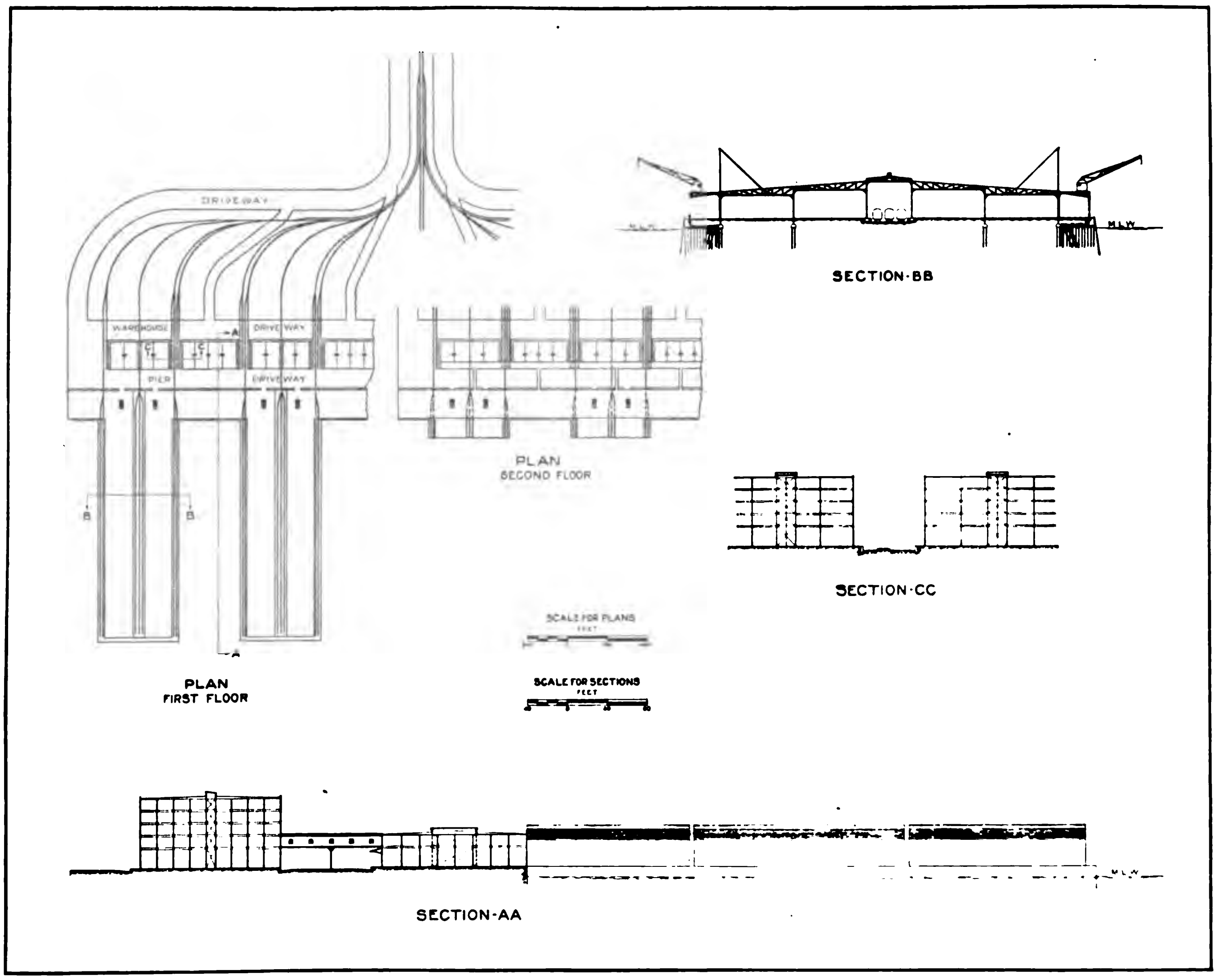
Freight between ship and dray will be handled by tractors and trailers from the tailboard at the bulkhead platform. That between car and ship will be handled by both tractors and trailers and hand trucks. That between warehouse and ship will be handled by tractors and trailers via overhead bridges, a longitudinal gallery on the second floor of the warehouses, and elevators.

Freight between lighter and ship will be handled by the prevailing methods; that between warehouse and lighter in the same manner as freight between warehouse and ship. That between dray and warehouse is to be handled via the platforms and driveways in the rear of the warehouses.

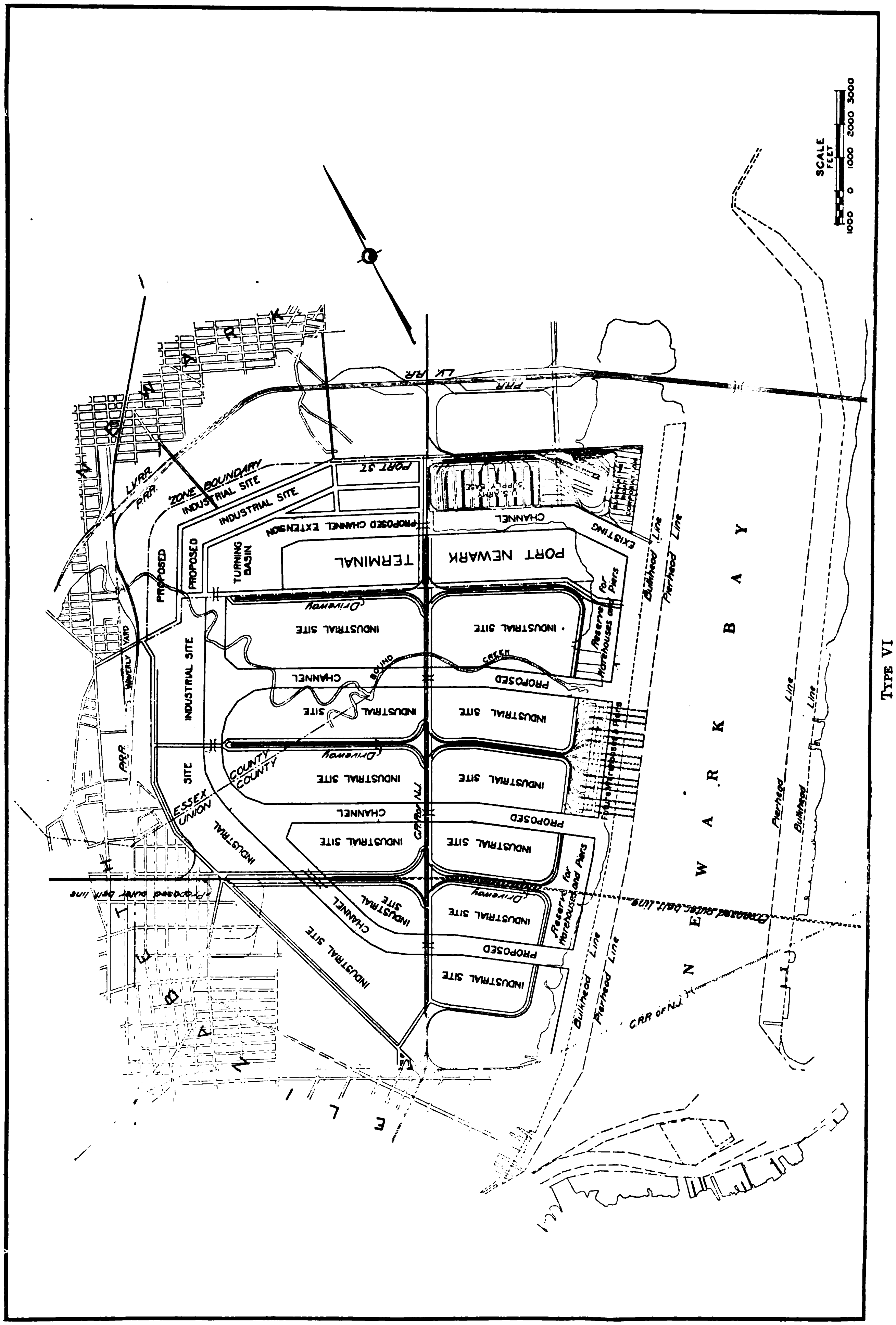
The second and third floors of the bulkhead shed provide for temporary storage and might, except for the gallery essential in handling freight between warehouse and ship and warehouse and lighter, be omitted.

Type VI

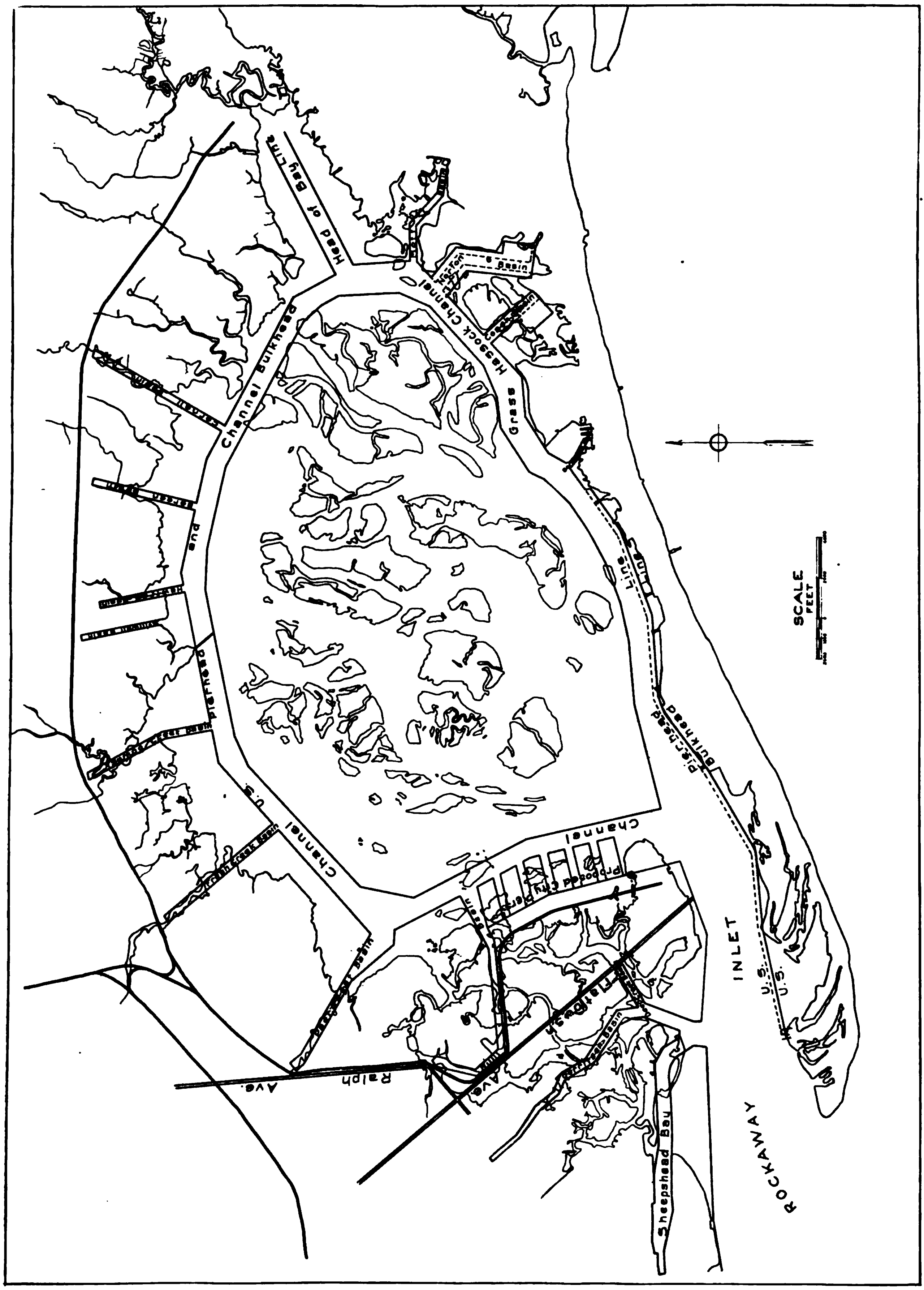
Type VI is a scheme for the development of the westerly shore of Newark Bay in the cities of Newark and Elizabeth. It is a canalization of the meadows similar to that already advocated by the city of New-



Type V


SCALE
FEET
1000 0 1000 2000 3000
NEWARK BAY
PORT NEWARK
TERMINAL
TURNING BASIN
PROPOSED CHANNEL EXTENSION
EXISTING CHANNEL
U.S. ARMY SUPPLY BASE
PORT ST.
INDUSTRIAL SITE
PROPOSED CHANNEL
BOUND CREEK
Driveway
Reserve for Warehouses and Piers
Bulkhead Line
Pierhead Line
ZONE BOUNDARY
PRR
LVRR
LV RR
WAVERLY YARD
ESSEX COUNTY
UNION COUNTY
C.R.R. of N.J.
Proposed outer belt line
NEWARK
ELIZABETH

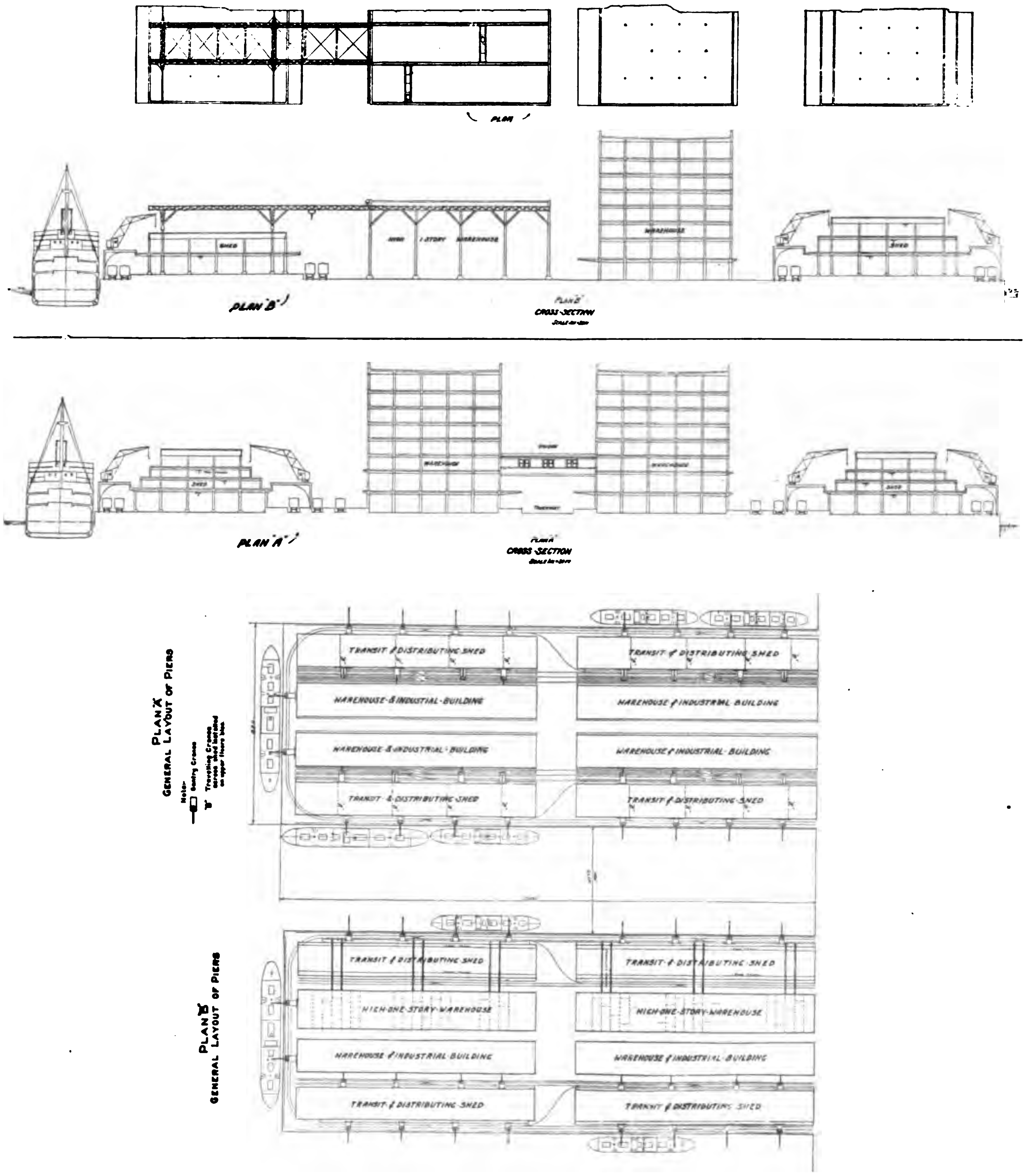
Type VI


Head of Bay Line
Channel Bulkhead
and
Pierhead
U.S.
Channel
Hassock Channel
Grass
Line
Pierhead
Bulkhead
Channel
Proposed City Piers
Basin
INLET
U.S.
U.S.
ROCKAWAY
Sheepshead Bay
Ralph
Ave.
Ave.
SCALE
FEET

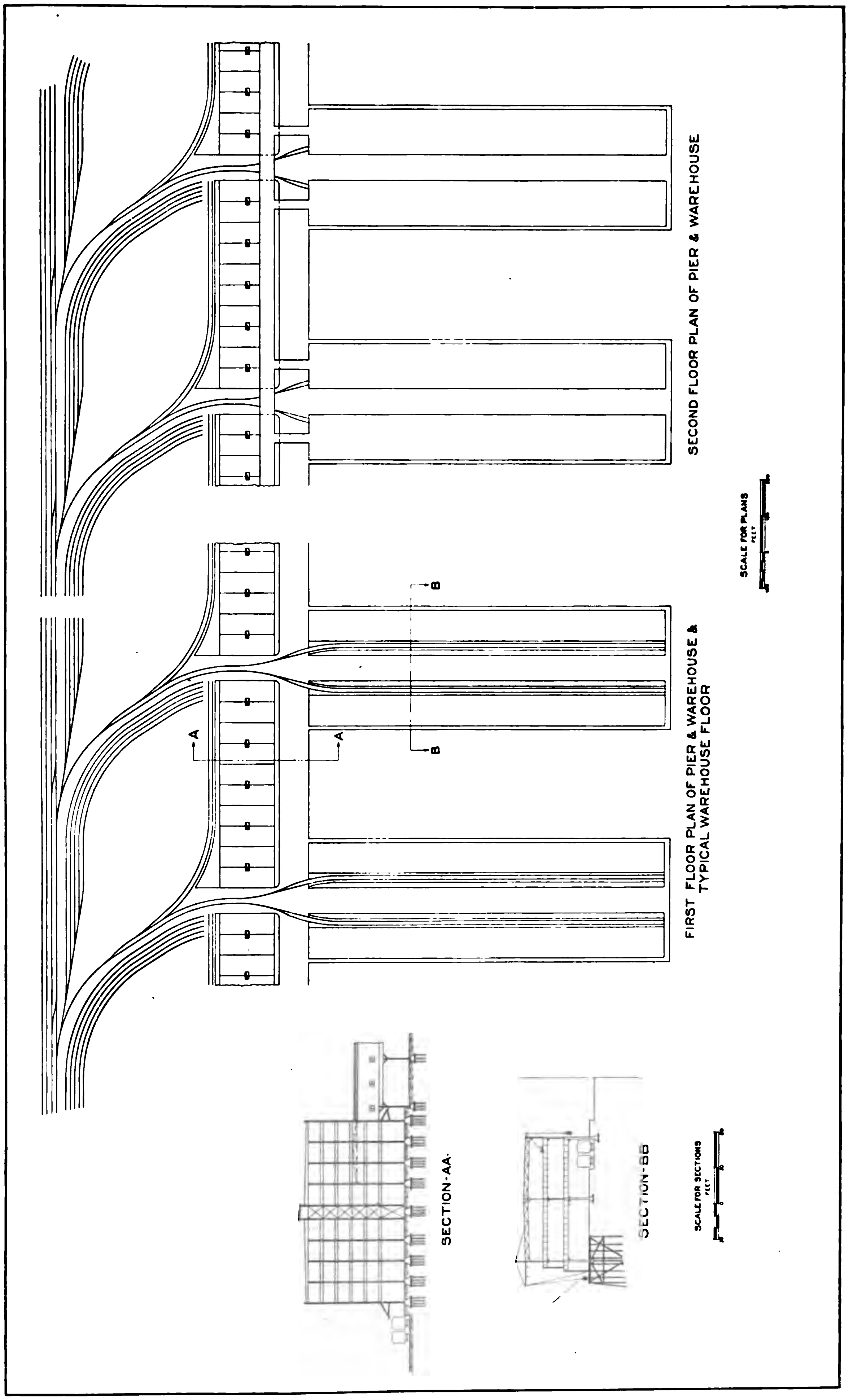
TYPE VII

ark, and consists of four canals from 6,000 to 12,000 ft. long, running inshore from a bulkhead line established 1,100 ft. westerly of the pierhead line. These canals are joined at their westerly ends by a canal running in the main in a northerly direction, forming three islands on the meadows. The most northerly canal has already been developed by the city of Newark for about one-half of its length, and on it are located the Submarine Boat Corporation and the sheds forming what is known as the United States Army Supply Base.

Here, if Newark and Elizabeth can agree as to sharing the use and cost of construction of the canal between them, an existing waterfront of 30,400 ft. can be made into a waterfront of 120,000 ft. by the cheapest method known for waterfront development, that is, the construction of bulkheads, excavation of canals and


PLAN
SHED
HIGH 1 STORY WAREHOUSE
WAREHOUSE
SHED
PLAN "B"
PLAN "B"
CROSS-SECTION
SHED
WAREHOUSE
WAREHOUSE
SHED
PLAN "A"
PLAN "A"
CROSS-SECTION
PLAN A
GENERAL LAYOUT OF PIERS
Note-
Gantry Cranes
Travelling Cranes
TRANSIT & DISTRIBUTING SHED
TRANSIT & DISTRIBUTING SHED
WAREHOUSE & INDUSTRIAL BUILDING
WAREHOUSE & INDUSTRIAL BUILDING
WAREHOUSE & INDUSTRIAL BUILDING
WAREHOUSE & INDUSTRIAL BUILDING
TRANSIT & DISTRIBUTING SHED
TRANSIT & DISTRIBUTING SHED
PLAN B
GENERAL LAYOUT OF PIERS
TRANSIT & DISTRIBUTING SHED
TRANSIT & DISTRIBUTING SHED
HIGH ONE STORY WAREHOUSE
HIGH ONE STORY WAREHOUSE
WAREHOUSE & INDUSTRIAL BUILDING
WAREHOUSE & INDUSTRIAL BUILDING
TRANSIT & DISTRIBUTING SHED
TRANSIT & DISTRIBUTING SHED

TYPE VIII


SECOND FLOOR PLAN OF PIER & WAREHOUSE
FIRST FLOOR PLAN OF PIER & WAREHOUSE & TYPICAL WAREHOUSE FLOOR
A
A
B
B
SCALE FOR PLANS
FEET
SECTION-AA
SECTION-BB
SCALE FOR SECTIONS
FEET

Type IX

utilization of the material excavated from the canals to form the necessary uplands.

The plan provides for access by car and dray to every foot of waterfront created, for reservations along the bay front, for future warehouses and for piers and bulkhead sheds with the necessary car and dray access as in Type V.

All tracks lead either out of the outer belt line in New Jersey or else from an inner or waterfront belt line which has direct connections with the outer belt line and by means of that line with all of the belt lines and railroads in the Port District. The driveways are connected with the highways of New Jersey.

This site will be peculiarly attractive to the class of industries which receive the bulk of their raw material by ship or export the bigger part of their products.

If the authorities in control so determine, industrial sites can be sold outright or leased on long-term leases. The governing authorities, however, should keep control of the tracks and roadways necessary for access to such sites, as well as of the channels along which they are located.

Such a development as this can start small and expand with the business to immense proportions provided that an adequate plan be adopted and adhered to along such lines as are herein indicated.

If a business is created which makes it necessary for ships with inbound cargo to call, it will not be long before outbound cargo for those ships will come.

TYPE VII

Type VII shows the series of channels and basins proposed by the City of New York for the development of Jamaica Bay. On it is indicated the location of the six piers suggested by the City of New York for the westerly end of the bay.

The Commission believes canalization along the lines of Type VI is peculiarly adaptable to this location, but its comprehensive plan provides for adequate rail connection from every railhead of the Port District to any piers that the city may elect to build.

TYPE VIII

Type VIII is a suggested plan prepared by the Department of Docks of the City of New York, showing a proposed character of development to meet the requirements which the Chief of Engineers of the United States Army recommended should be imposed as a condition to the authorization by Congress for extending the existing project for the improvement of Jamaica Bay to a depth of 30 ft. The piers are 850 ft. wide and 2000 ft. long. The slips between the piers are 400 ft. wide. The warehouses are on the piers themselves instead of on the hinterlands.

Gantry cranes and telpherage are the means relied upon for freight handling. Drays will enter the piers directly and tracks will run longitudinally on the piers.

The side wharfage of the six piers will berth forty-eight vessels of 3,600 tons net registry each, and if ships are permitted to tie up to the ends of the piers there will be berths for at least six additional vessels of that type. The fifty-four ships would have a total cargo carrying capacity of 405,000 gross tons.

TYPE IX

Type IX is a plan for three-story piers and multiple-story warehouses in a location where land is comparatively cheap and the railroad serving them is remote from the bulkhead line. On the pier are a central driveway for drays, two track wells, each providing for two lines of cars and two separate three-story sheds. Temporary storage tracks are provided for each pier, with a capacity of 95 cars per pier. Landing platforms are provided for each deck of the pier shed.

Freight will be handled from the ships by the use of an extended cargo mast, and from drays by whip hoists operated by motors on the interior of the third floor of the shed.

Cross galleries will connect the second floor of each pier shed with the second floor of the warehouse, 40 ft. of this floor being taken up with a longitudinal gallery with bridges from one warehouse to another, so that freight can be taken between any shed and any warehouse by tractors and trailers.

Freight between car and ship is to be handled by tractors and trailers, hand trucks or both. Freight between dray and ship is to be handled by whip hoists, trucks and cargo masts; that between lighter and ship as under the present system; that between warehouse and ship by tractors and trailers and cargo masts; that between warehouse and lighter in the same manner as between ship and warehouse; that between car and warehouse or between dray and warehouse by trucks and elevators.

CHAPTER 24

Channel Improvement

Expenditures by the United States Government on channels in New York Harbor have been far from proportional to the traffic of the Port. In the Ambrose Channel and the Main Ship-Bayside-Gedney Channel through the Lower Bay to the Narrows, New York is provided with excellent approaches to waterways which, however, are not sufficiently improved. There are also a number of bridges over various waters of the harbor which interfere with navigation and should be removed or remodelled.

LOWER BAY

Until 1914 the Main Ship-Bayside-Gedney Channel across the shoals of Sandy Hook was the chief entrance to the harbor. This channel, completed in 1891, had a width of 1,000 ft. and a minimum depth of 30 ft. To meet the needs of the largest liners, which draw well above 30 ft., the Ambrose Channel was dredged to the north of the Main Ship Channel. This new channel, 40 ft. deep and 2,000 ft. wide, was completed in 1914 at a cost of about $5,000,000.

Craven Shoal, in the Lower Bay a short distance from the Narrows, is at present being removed to a depth of 30 ft., and when this is completed the last obstacle to a clear way to the Upper Bay will have been removed. Other work is desirable, however, in the Lower Bay before it can be said to meet fully the needs of navigation. A project is under way for dredging three 21-ft. channels in the Raritan Bay. There should, however, be a 30-ft. channel through the bay to Perth Amboy. A 16-ft. channel is being provided between Staten Island and Hoffman and Swinburne Islands. The water along the entire southeasterly side of Staten Island is too shallow for commercial purposes, and deep water should be provided for the terminus of the outer belt line proposed on that shore.

UPPER BAY

The Narrows are a mile wide at the narrowest point, and from 60 to 100 ft. in depth, consequently they offer no obstruction to navigation. North of the Narrows a 40-ft. channel extends to the mouth of the Hudson, this channel being in places only 370 ft. wide, while to the east along the south Brooklyn shore is the so-called Red Hook Channel. Between the two channels is the shallower water known as the Anchorage Grounds, while the entire west side of the bay, except where channels have been dredged to certain facilities, is very shallow, for a width at points of two miles.

Projects are under contract for widening the main channel, for removing a rock ledge off pier A at the Battery to a depth of 40 ft., and for deepening the Red Hook Channel to 40 ft. The comprehensive plan, however, will bring into use the west side of the bay, and the Federal Government should be asked to dredge the entire bay as rapidly as possible from the present main channel to the New Jersey pierhead line to a depth of at least 25 feet.

HUDSON RIVER

In the Hudson River there is a main channel of 40-ft. minimum depth. This channel, which is 1,000 ft. or more in width, follows the Manhattan shores closely to about Nineteenth Street and thence turns out into the river. A shallower and narrower channel follows the New Jersey shore. Projects adopted are now under way for widening the main channel to 2,000 ft. from the Battery to Canal Street, and for deepening the west channel from Ellis Island to Hoboken to 30 ft., thence to Castle Point to 40 ft., and thence to Edgewater to 26 feet.

At the present time large ships, particularly those docking on the New Jersey shore, have difficulty in maneuvering because of the shoal water near the center of the river, and the projects now being carried out will not entirely eliminate this difficulty. The entire river from pierhead line to pierhead line should be dredged to 40 ft. as far north as Seventy-second Street, Manhattan.

There is no bridge across the Hudson south of Poughkeepsie. The Pennsylvania Railroad has twin tunnels under the river at Thirty-second Street, New York, and the Hudson & Manhattan (rapid-transit railroad) has two sets of tunnel crossings, one at Cortlandt Street and one at Morton Street. All of these tunnels are deep enough not to interfere with navigation. The same will be true of the interstate vehicular tunnel being built from Canal Street, New York, to Twelfth Street, Jersey City, and of the automatic-electric tunnels recommended by the Commission.

EAST RIVER

Originally the East River contained a great number of treacherous rocks and reefs. Many of these have been removed. Some years ago Congress approved a project for deepening the East River to 40 ft., but the depth through Hell Gate was reduced to 35 ft. when the contract was let. The Commission thinks it unfortunate that the standard depth of 40 ft. was not provided at Hell Gate, and believes it should be as soon as possible.

The obstructions in the river have doubtless had their effect in retarding the development of this waterfront as intensively as some other waterfronts have been developed, while the dangers of Hell Gate, partly but by no means wholly mitigated by the work the Government has already done there, have prevented full use of the shelter afforded by Long Island to ships in the New England trade, many vessels taking the outside route around Long Island rather than pass through Hell Gate.

Four public bridges — the Brooklyn, the Manhattan, the Williamsburgh and the Queensboro — span the East

River, while the Hell Gate Bridge of the New York Connecting Railroad spans Hell Gate from Long Island to Wards Island, with smaller spans over Little Hell Gate and the Bronx Kills. All of these bridges are high above the water, span virtually the entire clear waterway and offer no obstruction to navigation of the main channel. The auxiliary spans of Hell Gate Bridge, however, obstruct Little Hell Gate with a supporting pier in midstream.

There are a number of tunnels under the East River — two sets of the Interborough Rapid Transit Company and one of the Brooklyn Rapid Transit Company near the south end of Manhattan, the Pennsylvania tubes at Thirty-fourth Street, and rapid-transit tubes at Fourteenth, Forty-second and Sixtieth Streets. None of them interfere with navigation.

HARLEM RIVER

Aside from the opportunity it offers for local development, the Harlem River has an important potential use as a cutoff from the Hudson to the upper East River. When the Barge Canal has developed its expected traffic and the canal terminals on the Harlem and East Rivers are in full operation, the cutoff should materially reduce the congestion around lower Manhattan.

At present such use of the river is prevented by various obstructions, and by insufficient depth of channel. The principal obstructions are the drawbridge of the New York Central Railroad at Spuyten Duyvil, the sharp bends around the Johnson Iron Works, the midstream piers of High Bridge and the shoal water of the Bronx Kills. The Government has done considerable dredging work in the Hudson River in accordance with a project for providing a channel 15 ft. deep and 400 ft. wide, and it is understood that the project will be completed as soon as the obstructions referred to are removed.

Last year by Chapter 586 of the Laws of New York, 1919, there was created a Board of Conference, consisting of the State Engineer and Surveyor, the State Superintendent of Public Works and the Dock Commissioner of New York City, to study the river's needs. The Board made its report February 27, 1920. This Commission fully endorses its findings and takes the liberty of drawing freely from the report.

Spuyten Duyvil Drawbridge — The swing bridge of the New York Central's West Side freight line at Spuyten Duyvil is so low that virtually nothing larger than a rowboat can pass under it. The clearance should be, as the Board of Conference suggests, at least 24 feet.

Plans for the remodelling of the New York Central's West Side facilities have generally included a revised grade for the railroad to provide either a higher bridge or a tunnel under the river, and the Board of Conference urges that such a grade revision be required in any settlement of the West Side problem. The bridge will be entirely eliminated, however, if the Commission's plan for transferring the New York Central's freight operations to the Harlem and East Rivers is adopted.

Johnson Iron Works — About a quarter of a mile east of the Hudson River the channel of the Harlem River takes a sharp bend to the south in the shape of a horseshoe. The tongue of land within the horseshoe is occupied mainly by the Johnson Iron Works, while just to the north are the tracks of the New York Central Railroad. Various plans have been put forth to reduce the channel curvature at this point, by cutting off part of the tongue of land, where there are no important buildings, by cutting deeper and requiring the Johnson Company to seek new quarters, or by cutting straight through behind the iron works, which would necessitate a relocation of the New York Central tracks.

The Board favors the middle course, which follows a plan developed by the Government's engineers. This Commission will not attempt to compare the relative merits of the plans, but believes that one of them should be carried out. The matter has been under consideration many years. The Commission urges prompt action.

High Bridge — High Bridge, the old stone aqueduct of the Croton water supply across the Harlem River at 174th Street, Manhattan, is the most serious obstruction to navigation of the river. It consists of sixteen stone arches and has two piers in midstream which give only 44 ft. horizontal clearance at the foundations, barring the way to any but small vessels, and the strong currents that flow between the piers make the passage dangerous even for small craft.

The United States War Department has ordered the removal of the midstream piers. The structure is not an essential part of New York City's present water supply, and could be entirely removed. Because of its historical and aesthetic value, however, efforts are being made to have the bridge saved and the three river arches replaced by a single arch spanning the entire channel. A decision ought to be reached soon, for the present conditions hold back the entire river improvement.

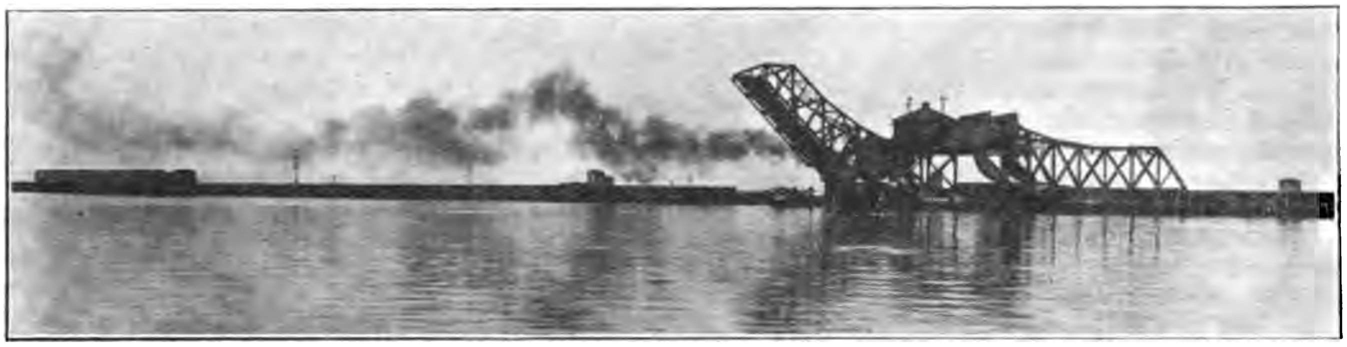
Bronx Kills — "The Harlem or Bronx Kills," states the Board, "is a shallow and much obstructed waterway about 4,000 ft. in length, separating Randall's Island from the mainland and connecting the Harlem River and the East River. Its depth varies from nothing to 20 ft. at mean low water."

The Federal project adopted does not include widening and deepening the Kills. The Government has, however, made several surveys and estimates for this work.

With these main obstacles to navigation of the Harlem River removed, there still will remain eleven other bridges over the river. One of these is the high Washington Bridge at 181st Street, which spans the entire channel and offers no impediment whatever to navigation. The other ten are drawbridges sufficiently high to permit many tugs and scows to pass under them, and so are not very objectionable in view of the character and volume of traffic the river is likely to carry.

JAMAICA BAY

A number of years ago the Federal Government and the City of New York entered an agreement for the joint development of Jamaica Bay, the Federal Government to dredge a main entrance at Rockaway Inlet, and the city to dredge a channel around the periphery of the bay. The agreement called for a first depth of 18 ft. and width of 500 ft., these to be increased to a depth of 30 ft. and width of 1,000 ft., with 1,500 ft. at the entrance, when commerce should require the increases.



Railroad Bridge Across Newark Bay — Bascule Bridge with Lift Spans Through Which All Boats Must Pass

This work has progressed slowly, part of the main channel and one or two laterals on the west side of the bay having been dredged. The work has been held up by litigation brought against the city by certain private interests and by the apparent necessity for additional congressional action.

The co-operative plan should proceed, although it is so great in extent that the work can well be carried over a term of years, keeping just in advance of the demands of industrial and commercial development.

A trestle bridge with two draw spans, owned and used by the Long Island Railroad, crosses the bay from north to south at about its center. The War Department has recently authorized the construction of a much needed highway bridge parallel to and east of the railroad bridge. Neither the existing bridge nor the proposed bridge need be regarded as obstructions to navigation. For many years to come development of the bay will naturally be on its north westerly side, nearest the center of the Port District and west of these bridges.

OTHER CHANNELS IN NEW YORK

Other authorized government projects include the provision of a 20-ft. channel in Newtown Creek, a 10-ft. channel in the Bronx River, a channel in Flushing Bay graduated from 10 to 17 ft. in depth, an 8-ft. channel in Westchester Creek and a 5-ft. channel in Eastchester Creek. These channels are all needed and the Commission urges their completion at as early a date as possible.

Navigation of some of these waters is greatly impeded by bridges. Although Newtown Creek has a heavier tonnage than the Mississippi River above New Orleans, it is crossed by a number of bridges. The Commission has not found opportunity to make detail studies to determine whether any of these bridges can be consolidated or eliminated, but urges that that be done by a duly constituted authority.

NEWARK BAY

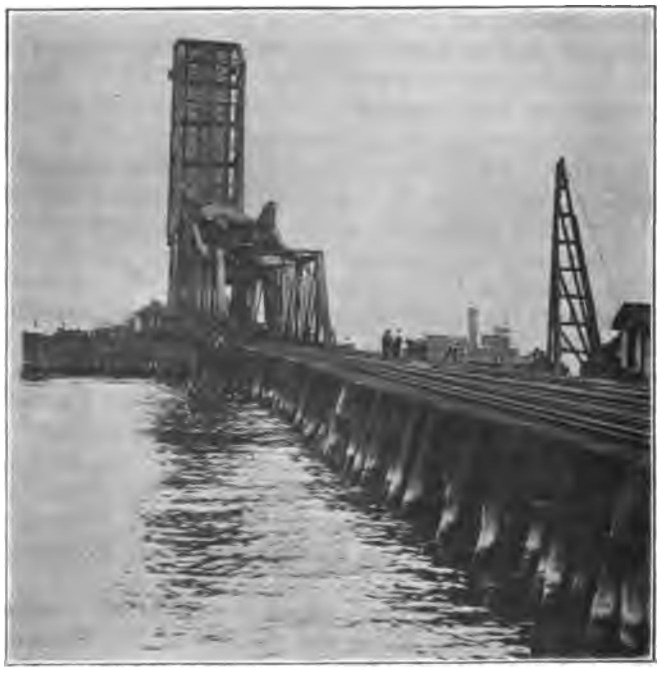
Newark Bay is at present served by a channel which runs diagonally from a draw span near the east end of the bridge of the Central Railroad of New Jersey to a more central position farther north. The bay is reached by a 20-ft. channel in the Kill van Kull, a sharp turn being required at the junction of the two channels. A project is now under way for deepening the channel to 30 ft. and widening it to 400 ft. for the entire length of the bay.

This project when completed will hardly meet the needs of the bay and its tributary rivers. The city of Newark, through its Port Newark terminal development created some years ago, has made a substantial beginning to the opening up of the west side of Newark Bay for shipping. The city of Jersey City is planning a development along similar lines on the east side of the bay and the lower Hackensack River. Shipbuilding plants were established at the head of the bay during the war, and there is every reason to look for the location of other industries along the navigable waters of this section of the Port as soon as the railroad facilities provided in the comprehensive plan are available.

Channels should be dredged by the Federal Government along the pierhead lines on both sides of the bay, and ultimately the entire bay should be dredged to the depth of the projected channel. The shoal off Bergen Point should be removed so that ships entering the bay from Kill van Kull can turn close to the point.

The bridges across Newark Bay present a problem. In their present form they are a serious obstruction to navigation, yet they are important links in the railroad system of the Port, and cannot be ruthlessly destroyed.

The Central Railroad of New Jersey is planning to



Bascule Bridge, Newark Bay — One Lift Span Open — Note Trestle Approaches, Short Spans and Low Clearance rebuild in the near future its bridge across the south end of the bay, providing longer and higher fixed spans and wider openings at the lift spans. Before a positive decision is reached the Commission urges that full consideration be given to the replacement of the bridge by a tunnel, as has been advocated. If this is impracticable the bridge should be rebuilt at once in accordance with a design providing for a minimum of interference with land and water traffic, as the present structure is a serious menace to navigation and deterrent to the proper development of the bay.

It is understood that the bridge farther up the bay, used jointly for freight service by the Pennsylvania and Lehigh Valley railroads, is also to be rebuilt. There is agitation for a highway bridge at the same point, the need for which will probably be accentuated by the opening of the first vehicular tunnel under the Hudson. The highway bridge could parallel the railroad bridge or be a part of it as a second deck. If a separate structure, it should be built close to the railroad bridge, and whether one bridge or two is built, ample provision should be made for future traffic to avoid the necessity later on for additional bridges.

Here also tunnels if possible should be built rather than bridges. The Commission assumes that any crossings of the bay as part of the proposed exterior belt-line system will be by tunnel.

In comparatively recent years the Central Railroad of New Jersey, in reconstructing the bridges on its Newark branch, has been permitted to narrow the openings at the mouths of the Hackensack and Passaic Rivers. The Commission endorses the efforts of the New Jersey Board of Commerce and Navigation to have the full width of these rivers restored, and urges that any further narrowing of existing narrow waterways be prohibited.

HACKENSACK RIVER

Development of the Hackensack River is retarded by the shoal water at its mouth. A government project at present under way provides for the dredging of a channel 16 ft. deep and 300 ft. wide through this shoal to deep water above the Central Railroad of New Jersey bridge. From this point the project calls for a 12-ft. channel 200 ft. wide to Little Ferry and thence 150 ft. wide to the bridge of the New York, Susquehanna & Western Railroad at Hackensack.

Comparatively little use has been made of the Hackensack River for the reason that its navigable section lies almost wholly within the unreclaimed Hackensack Meadows. As suggested in Chapter 23 on sectional development of the Port, these meadows, ideally situated geographically and with an abundance of railroad connections, are unlikely to be permitted to lie waste indefinitely. A deeper channel than that provided by the Government's present project will no doubt be needed in the comparatively near future.

Three Contiguous Drawbridges — Railroad, Highway and Railroad — Over the Hackensack River — An Unnecessary Hindrance to Navigation — Why Not Combine and Modernize?

An unnecessary number of bridges cross the river. Three of these, the ones carrying the Boulevard and freight and passenger tracks respectively of the Pennsylvania Railroad, are so close together as to render navigation hazardous. They could and should be combined in a single structure. Other crossings will undoubtedly be required in the future, but every effort should be made to combine them with existing structures, and otherwise keep down the number of crossings.

PASSAIC RIVER

Dredging authorized by the Government will provide a channel 20 ft. deep and 300 ft. wide up the Passaic River to the Nairn Linoleum Works, thence 16 ft. deep and 200 ft. wide to the bridge of the Greenwood Lake branch of the Erie, thence 7 to 12 ft. deep and 150 ft. wide through Belleville Bar, thence 6 ft. and from 50 to 100 ft. wide to Passaic. Just above Passaic the river is closed to navigation by the dam of the Dundee Water Power & Land Company.

Passaic, Garfield and Paterson are all manufacturing cities, and their industries could make good use of the river if it would float vesels of sufficient draft. The river should be dredged as soon as possible to provide a continuous channel of 12-ft. depth as far as Passaic, and ultimately this should be extended to Paterson. At present there is an obstacle in the way of this extension in the dam of the Dundee Water Power & Land Company just north of Passaic, and the control over navigation vested in that company. The company has a charter right to build a canal and locks around the dam and charge tolls for the movement of passengers and freight. It has built the canal and a lock at the upper end, but has not provided the necessary lock at the lower end to make navigation possible.

Negotiations conducted by the New Jersey State Board of Commerce and Navigation have resulted in a tentative agreement on the part of the company to waive its rights in respect to this canal and contribute to the cost of completing it, provided the State or National Government will do the work. A formal agreement establishing the public right of navigation should be entered into at once by the State. The Federal Government should then be asked to dredge the river up to Passaic, the State or city should provide a public terminal at that point to serve not only Passaic but Paterson and the intervening communities, and when the traffic warrants it the Government should be asked to extend the channel to Paterson.

There are a number of bridges over the Passaic River between its mouth and the city of Paterson. Those over the lower end, opposite the city of Newark, are so located as not to form serious obstacles to navigation. Above Passaic are a number of fixed bridges which will of course have to be removed or remodelled if this part of the river is made navigable.

ARTHUR KILL

The Arthur Kill is at present being deepened to 25 ft. by government dredging. The kill carries a tonnage estimated at more than 30,000,000 tons per year and it should be dredged to 30 ft. in order to accommodate the large freight ships serving the numerous industries located or likely to be located along its shores. An entrance channel providing the full draft of 30 ft. should be dredged to deep water in Raritan Bay.

RARITAN RIVER

Elsewhere in the report the Commission suggests a branch of the outer belt line to the north bank of the Raritan River west of Perth Amboy — a section admirable for industrial development. A government project now under way provides a main channel 16 ft. deep and 200 ft. wide up the river from deep water to Sayreville and thence 10 ft. deep to New Brunswick, with a south channel 10 ft. deep and 160 ft. wide as far as Sayreville. Utilization of this district in the manner recommended by the Commission will necessitate extension of the 30-ft. channel proposed for Raritan Bay up the river at least five miles.

The river is crossed at its mouth by a railroad bridge used by the Central Railroad of New Jersey and the Pennsylvania and by a highway bridge. Both are necessary structures and neither is a serious impediment to navigation.

OTHER NEW JERSEY WATERWAYS

Channels are at present authorized by the Government in tidal waters in New Jersey as follows:

A 6-ft. channel in the Elizabeth River, an 8-ft. channel in Woodbridge Creek, an 8-ft. channel in the South River, a graduated channel from 5 to 3 ft. deep in Cheesequake and Stump Creeks, an 8-ft. channel in Keyport Harbor, a 4-ft. channel in Matawan Creek and a 4-ft. channel in Shoal Harbor and Compton Creek. The widths of these channels range from 50 to 200 ft. The Commission believes they are in general in keeping with the needs of the sections they serve, and urges that they be continued to completion at as early a date as practicable.

GENERAL

Three forms of access, the Commission believes, are essential for any waterfront development — rail, highway and water. In other chapters the Commission suggests forms of development suitable for various sections of the Port, but does not attempt to specify precise locations. Channels of adequate depth and width should be provided for any such developments, whether or not they are covered by present authorized projects or channel improvements definitely recommended in this chapter.

CHAPTER 25

New York Barge Canal and Its Terminals at the Port of New York

New York State is just completing the remodelling of its canal system — an undertaking that has been in progress for about fifteen years. The work was sufficiently advanced so that the enlarged waterway was put into service in 1918. Abnormal conditions created by the war, Federal operation of the canal, lack of modern canal equipment and the incomplete state of the terminals at the Port of New York and elsewhere have all doubtless been contributing causes to the failure in the first two years of the improved system's operation of any considerable tonnage to materialize. A low-water mark for canal traffic was reached in 1918, and the 1919 figures were not much larger. As this chapter was written before the 1920 season of navigation was closed, the 1920 figures were not available. The canals have great possibilities of relieving the railroads of certain classes of freight, and it is highly important that there be terminals at the Port of New York as well as at the lake ports and other cities along its route adequate to handle efficiently such tonnage as develops. Certain terminals have been completed and put into operation. Others are under construction. Still others are likely to be needed when the operation of the canal system reaches a normal basis.

Erie Canal

The Erie Canal was the first connected transportation agency across New York State. It was opened in 1825 for navigation by boats of about 75 tons. The Champlain, Oswego and Cayuga-Seneca canals were built about the same time. In 1862 an enlargement of the Erie Canal was completed which made it navigable by boats of 240 tons.

From the first the Erie Canal carried a heavy traffic, which increased gradually to a maximum of 6,673,370 tons in 1872. Up to 1893 tolls were charged which netted the State $42,599,717.25 exclusive of interest on the canal debts.

About 1880 the traffic began to diminish, owing to sharp railroad competition, lack of suitable terminals, lack of canal service during part of the year, and other factors. By 1895 the annual traffic had dropped to 3,500,314 tons. It was felt that the existing canal had become inadequate, but that there was a demand for better water transportation. The latter sentiment resulted in the vote in 1903 to enlarge the old Erie Canal system, including the Champlain and Oswego branches, to the present Barge Canal. The work was started in 1904, and the enlarged waterway, which utilizes the bed of the old Erie Canal in part and in part follows the Mohawk River and other watercourses, was officially opened May 15, 1918, parts of the system having been in operation a year or two earlier.

When the United States Government took over the railroads in December, 1917, it was anticipated that the trunk lines between New York and Buffalo, as elsewhere, would be taxed to their utmost with the grain movement in 1918. To provide and control a means of overflow the Railroad Administration entered into an agreement with the State of New York to operate boats on the Barge Canal, the State to maintain and operate the canal. The Railroad Administration chartered practically all of the old Erie Canal boats that were fit for use, and moved upward of 500,000 tons of freight during the year 1919, the bulk of this being through shipments of grain. The total traffic on the State canal system in 1919, exclusive of the Black River Canal, was 1,234,008 tons, according to the annual report of the Superintendent of Public Works.

The Cummins law returning the railroads to private control contained a provision continuing the operations of the Federal Government on the Barge Canal under the Secretary of War. A subsequent bill terminating this public operation failed of passage. The enlarged canal has not as yet, therefore, been operated under normal conditions.

Barges for the Canal

On the old Erie Canal, as on the majority of the early canals, mules were the chief motive power, the mules being driven along a towing path on one side of the canal. The boats were small, and two or three were ordinarily hauled in one tow. The tows made perhaps three miles per hour in the open, but when two tows met considerable maneuvering, with consequent loss of time, was required to effect a passing. Much time was also lost at the locks, which were numerous, and large enough for only one boat at a time, so that the tows had to be broken up. Conditions were particularly bad at two points where there were several locks in close succession.

Tugboats came to be used to some extent on the old canal. The small size of the locks and the shallow depth of the canal, however, tended to prevent any marked development in the boats, and those in use in 1915 were probably not greatly different from those of Civil War times.

With the enlargement of the canal and its locks (accompanied by a great reduction in the number of locks), it was assumed that a more efficient plan of operation would be adopted, which would involve either self-propulsion or towing by power boats in larger fleets, and the old towing path was eliminated. Probably it was too much taken for granted that boats capable of taking full advantage of the new conditions would appear at the proper time, and the disappointing showing of the enlarged canal to date is doubtless due in no small measure to the failure of such boats to make their appearance. Prior to the opening date in 1918 practically nothing has been done toward developing a new fleet.

The canal is 12 ft. deep and the locks are 300 x 45 ft., so that vessels of considerable size are possible. They must, however, pass under bridges 15½ ft. above the water surface. Some attempts have been made toward developing a shallow self-propelled ship that will pass under the bridges and still be able to navigate the Great Lakes. The tendency, however, seems to be toward barges from 130 to 150 ft. long and 21½ ft. wide. The United States Railroad Administration placed in service fifty-seven of them, mostly steel, and all non-self-propelled. Some twenty power barges ordered by the Railroad Administration have recently been completed or are soon to be completed. One power barge can haul three of the others, and the four, two abreast, can pass together through a lock.

Private interests have put on a few barges in keeping with the character of the improved canal system. More equipment of the modern type is needed, however, to enable the canal to handle a tonnage commensurate with its capacity.

The canal system is best adapted to the handling of coarse freight in bulk. Its bearing on the handling of export grain is set forth in some detail in Chapter 29.

Barge Canal Terminals

When it was first decided by popular vote to enlarge the old Erie Canal and its tributaries, the necessity for adequate terminals had not been fully realized. In consequence the development of such terminals has not kept pace with the enlargement of the canal itself.

The first appropriation for terminals became available in 1911. The amount of this appropriation was $19,800,000, as compared with $108,000,000 previously appropriated for the reconstruction of the canal. Definite allotments of the terminal fund were made to the larger cities, and a part of the fund was assigned to a group of the smaller places. Small appropriations for terminal purposes were made in 1918, and $2,625,000 were appropriated in 1920 for completing terminals at various points and beginning the construction of two elevators — one at Gowanus Bay, Brooklyn, and the other at Oswego.

Progress has been continued on the construction and equipment of the canal terminals, although at a slower rate than formerly on account of the exhaustion of most of the quotas allocated to the various cities by the terminal act of 1911. Partly on account of the incomplete state of the terminals, partly because of the location of the terminals in new and unusual sections of the cities and partly because of the lack of a business-getting organization for the canal, these terminals have not been extensively used.

New York City's Terminals

Slightly less than half of the total amount of money appropriated for Barge Canal terminals has been assigned to New York City. The accompanying table indicates their location, the amount of available wharfage and the estimated capacity per season. The locations are not precisely those mentioned in the terminal act, which left a certain amount of latitude.

New York City's Barge Canal Terminal

Name	Location	Available wharfage, lin. ft.	Capacity per season, tons
Piers 5 and 6	Coenties Slip, East River	2,690	538,000
West 53d street	Pier 93, North River	1,490	298,000
Mott Haven	Below Madison Ave. bridge	603	120,600
Gowanus Bay	Foot of Henry street	5,296	1,959,600
Greenpoint	Foot of Dupont street	2,262	452,400
Long Island City	Foot of Rogers street	681	136,200
Hallet's Cove	Broadway, Astoria	1,213	242,600
Flushing	Head of Flushing Bay	550	110,000
		14,787	2,957,400

Piers 5 and 6 — Piers 5 and 6, with 4, 7 and 8, are reserved by the city charter for canal and Hudson River traffic except during winter. Piers 4, 7 and 8 have not been used for this traffic in recent years. For Barge Canal terminal purposes the State has taken over Piers 5 and 6, half of each slip adjacent to Piers 4 and 7 respectively, and the bulkheads. Pier 6 is 559 x 85 ft., with a steel shed and headhouse 490 x 50 ft. The shed is located along one side of the pier. On that side it carries two traveling conveyor roof cranes, while contracts have been let for the installation of two semi-portal cranes on the opposite side. Pier 5, which is somewhat narrower than Pier 6, has a shed but carries no crane equipment.

Pier 93, West Fifty-third Street — The West Fifty-third Street terminal, Pier 93, Hudson River, is a pier 700 x 90 ft., part of which is covered by a freight shed now nearly completed. Two semi-portal cranes are under contract to be installed at the pier. Access will be had from Twelfth Avenue and the Marginal Way. The terminal comprises 209,771 square feet.

Mott Haven — The Mott Haven terminal is on a long, narrow parcel of 106,830 sq. ft. near the Madison Avenue bridge, between Exterior Street and the Harlem River. This is a quay type terminal, with a 200 x 50-ft. shed. Ultimately a full-portal crane is contemplated to run the full length of the 603-ft. quay.

Gowanus Bay — The Gowanus Bay terminal is intended as a transshipment terminal between canal boats and steamships. Its site contains 2,070,990 sq. ft., with 1,037 ft. frontage on Gowanus Bay and 2,491 ft. along the Henry Street basin. The plan contemplates two pile piers each about 1,200 x 150 ft., together with bulkhead space. One of the piers has been virtually completed and a contract has been let for a freight shed on it. A depth of water of 35 ft. has been provided. The New York Legislature this year appropriated $500,000 to be applied toward the construction of a grain elevator at this terminal to receive the contents of barges from the Great Lakes. The total cost of the elevator is to be about $2,500,000.

Greenpoint — The Greenpoint terminal lies along Newtown Creek. The site contains 402,810 sq. ft. A pier 410 x 90 ft. has been virtually completed, as well as a freight shed on it, and a contract has been let for two semi-portal cranes. Another smaller pier and

550 ft. of bulkhead are to be built, and an existing pier is being rebuilt.

Pending the development of canal commerce at this terminal the Superintendent of Public Works, with the approval of the Canal Board, has recently awarded a revocable permit to a steamship company to use the pier, largely for the direct transfer of grain from canal barges to ocean-going vessels. The State can reclaim the pier on short notice.

Straight-Line Roof Cranes on Barge Canal Terminal — Pier 6, East River, Manhattan

Long Island City—The Long Island City site is about 680 x 150 ft., occupying about 102,000 sq. ft. There is no public access by land. The terminal consists of a quay wall about 700 ft. long, a freight shed 200 x 50 ft. and a locomotive crane running the length of the quay.

Hallet's Cove—The Hallet's Cove site contains 160,270 sq. ft., bounded by the East River, the Boulevard and Broadway. The river frontage is 449 ft. The construction of the terminal has just been actively started. There will be a slip 120 ft. wide, a shed 240 x 50 ft. and a locomotive crane on a 465-ft. track.

Flushing—At Flushing the layout calls for a 550-ft. quay roughly parallel to the channel of the Flushing River, a locomotive crane traveling its entire length and a 200 x 60-ft. shed. The terminal is about one-third completed.

In general the facilities are specially designed to handle package freight, but bulk freight can also be readily handled outside of the freight sheds. At only one of the terminals, that at Gowanus Bay, is sufficient depth of water provided to permit transshipment to and from ocean-going vessels. Ordinarily the canal barges, if not more than 150 ft. long, will when handling exports or imports be taken alongside the ships or their piers, as in the case of lighters.

MORE TERMINALS NEEDED

As the Barge Canal system is purely a New York State enterprise, the terminals are naturally within New York State. A question is presented whether there should not be terminals on the New Jersey waterfront as part of the general project of unifying the Port irrespective of State lines. There will certainly be need for a terminal at Piermont, at the north end of the outer belt line, and this terminal, as pointed out in Chapter 29, should include a grain elevator for local rail distribution. Canal barges should also have unhampered access to the large elevator recommended at or near the south terminus of the exterior belt line to serve the New Jersey railroads in their export grain business.

At the present time only the terminal at Piers 5 and 6 of those already constructed is used for canal purposes to any considerable extent. Some of them are, however, being put to other profitable uses pending the need for them for canal traffic, the State thus at once deriving an income from them and assisting the other commerce of the Port by providing facilities for it.

Semi-Portal Gantry Cranes on Barge Canal Terminal — Pier 6, East River, Manhattan

CHAPTER 26

Other Canals and Inland Waterways Affecting the Commerce of the Port

Besides the New York Barge Canal system to which the preceding chapter is devoted, there are a number of existing canals which have more or less bearing on the commerce of the Port, and still others projected for the future need to be taken into account. Of the former the Delaware and Raritan Canal, the Chesapeake and Delaware Canal and the Cape Cod Canal are the most significant to the Port. Of the latter the Gravesend Bay-Jamaica Bay Canal and the New Jersey Ship Canal are of particular importance, and highly to be desired.

Existing Canals

Among the inland canals the Morris Canal may be dismissed with a few words. Running from Jersey City to Phillipsburg, N. J., 102 miles, it crosses the ranges of hills, ascending more than 900 ft. by a series of planes and locks. These planes and the canal's small size render it of little value for modern purposes. In 1886 it carried 889,220 tons of freight; in 1913, 38,926 tons; since then it has carried practically nothing. The Lehigh Valley Railroad has controlled it since 1871. It could not be enlarged to carry boats of normal size except at great expense, and if enlarged could not be made to pay. It has, however, an extremely valuable terminal property in the Morris Canal Basin at Jersey City.

Another inland canal considered, but found of little value to this port, is the Lehigh Canal, running from Wrights Creek, Pa., along the Lehigh and Delaware rivers to Bristol, Pa., 120 miles. It also is small and could not be expected to serve the Port of New York materially.

DELAWARE AND RARITAN CANAL

The Delaware and Raritan Canal connects the Delaware River at Bordentown, N. J., with the Raritan River at New Brunswick. It has locks and a channel suitable for boats 140 ft. long and 23 ft. wide, drawing 7 ft. and carrying 600 tons. It carried a maximum traffic of nearly 3,000,000 tons in 1872, but only 1,001,056 tons in 1891 and 304,700 tons in 1917. The canal is closed an average of about three months each winter.

Since 1871 this canal has been under lease to the Pennsylvania Railroad, which has not operated it with a view to developing traffic. The tolls are almost prohibitive. The railroad has used it mainly as a relief facility in times of congestion.

Enlargement of the canal to a depth of 12 ft. or more is impracticable because of inadequate water supply and local conditions at Trenton. A sea-level canal in the present location is not feasible.

CHESAPEAKE AND DELAWARE CANAL

The Chesapeake and Delaware Canal connects the Chesapeake and Delaware Bays, being 14 miles long. It is 9 ft. deep and will accommodate boats of 750 tons. It has no towpath. Its maximum traffic of 1,318,772 tons in 1872 has dwindled to an average for the last ten years of 867,222 tons. As its coal traffic has diminished, the movement of lumber and forest products has increased, though to a lesser extent. Two-thirds of the traffic is normally northbound. High tolls were charged on the canal while it was under private control. In August, 1919, the Federal Government bought the canal and abolished the tolls.

This canal is usually open nearly the entire year. It reduces the distance from Philadelphia to Baltimore 317 miles as compared with the open sea, and that from New York to Baltimore 236 miles. Transportation is carried on mainly by a line of self-propelled barges operating between Philadelphia and Baltimore, and a good sized fleet of tugs and towed barges another company operates between Philadelphia and far Southern points.

NEW JERSEY INLAND WATERWAY

A partly artificial waterway which has been under construction or improvement several years is the New Jersey Inland Waterway. This runs from near Cape May along the New Jersey coast to the upper end of Barnegat Bay, connecting the existing rivers and sounds behind the fringe of beach. The channel is 6 ft. deep and has a bottom width of 100 ft. A considerable sum has been spent since the canal was started in 1908, and the channel is finished and in operation for 117 miles, to the north of Barnegat Bay. Work on the extension from this point to the Manasquan River is progressing slowly.

Thus far this waterway has had little effect on the Port of New York. It is used to a considerable extent by pleasure craft and also for the movement of produce and fish. Regular passenger lines also operate on it.

Congress in 1916 authorized an examination, survey and estimate of cost for an inland waterway, 15 ft. deep, from Cape May to New York, utilizing the present waterway. The resulting report was unfavorable. There is no immediate likelihood of extension north of the Shrewsbury River, which empties into Sandy Hook Bay, an arm of the Lower New York Bay. Without this extension the canal has little interest for New York.

CAPE COD CANAL

A canal having an important bearing on the Port of New York, though a considerable distance from it, is the Cape Cod Canal. This ship canal, which was opened in 1916, extends across Cape Cod, connecting Buzzards Bay with Cape Cod Bay. With its dredged approaches it is 13 miles long. It is 25 ft. deep, with a bottom width of 100 ft. It reduces the distance between New York and Boston from 326 to 260 miles, and eliminates the dangerous ocean navigation around the cape.

In 1916, the first year of its operation, the canal carried 3,619,883 tons. In 1918 the Railroad Administration took charge of it. It has been turned back to the original owners, but negotiations are under way which may result in permanent Government control. Coastwise shipping amounting to 20,000,000 or 25,000,000 tons annually passes around the cape. Because of its limited width the canal is a one-way waterway for large vessels. With the canal widened and tolls eliminated or reduced under Government operation it is thought the greater part of the coastwise shipping would use the canal.

Proposed Canals

Various canal projects affecting the Port of New York have been agitated from time to time. The most important of these is the intracoastal system, which in prospect extends from Boston to Florida, with a channel 12 ft. deep or more north of Beaufort Inlet, N. C., and 7 ft. deep south of there. Relatively a small part of this would require an artificial channel, existing sounds, bays and rivers being utilized fully.

Three links of this are the Cape Cod Canal, the proposed New Jersey Ship Canal and an enlarged Chesapeake and Delaware Canal. Only the first of these has been built, as previously related, and it is at present privately owned.

NEW JERSEY SHIP CANAL

The proposed New Jersey Ship Canal would be roughly parallel to although some distance from the Delaware and Raritan Canal, but would be much more direct. It would preferably be a sea-level canal, following an almost direct route from Morgan on Raritan Bay to Bordentown on the Delaware River. It would shorten the present canal mileage from 44 to 33 miles, but the Delaware River and Raritan Bay would have to be deepened for some distance. The canal would occupy a natural valley and cross no railroad trunk line.

By this canal the distance from New York to Philadelphia for ships would be reduced from 274 to 87 miles. The route has been surveyed. Construction with a 25-ft. depth and 125-ft. bottom width was approved in 1912 by a special board of engineers of the War Department. In 1913 the chief of engineers reported in favor of a lock canal of 12-ft. depth and 90-ft. bottom width, susceptible to later elimination of locks and enlargement to the larger dimensions. The New Jersey Board of Commerce and Navigation in 1916 advocated the larger sea-level canal, and the New Jersey Legislature in 1917 passed an act authorizing the Board to acquire the right-of-way for such a canal and cede it to the Federal Government, conditional on a Federal appropriation for construction. The chief of engineers, in a report made August 9, 1918, while recommending early construction, held to the smaller lock canal, the cost of which was estimated at $20,000,000 as compared with a figure of $45,000,000 for the 25-ft. sea-level channel.

It has been conservatively estimated that a ship canal would carry 5,200,000 tons of cargo annually in its early years, and develop more. A large percentage of the freight would originate in, be delivered to or be transshipped at the Port of New York. As compared with the outside route, the canal would save time, promote more regularity of sailings, permit the use of box barges costing less than half as much per carrying ton as ocean-going barges, and make smaller crews possible. The maximum saving in such transportation would be effected when both shipper and consignee have water terminals but no rail sidings.

It is apparent that a large amount of freight would be available for the New Jersey Ship Canal as soon as it is built. This and other ports need it and it should be built.

ENLARGED CHESAPEAKE AND DELAWARE CANAL

A Federal commission in 1907 recommended the purchase of the Chesapeake and Delaware Canal at a price not to exceed $2,514,289.70, and purchase was made at this price last year. An estimate made in 1911 placed the cost of developing the canal to a 25-ft. sea-level waterway at $9,910,210. The special board of engineers estimated that at least 2,537,622 tons of freight would use such a canal annually, even if the New Jersey Ship Canal were not built. The chief of engineers in 1913 reported himself in substantial agreement with the Federal commission. He recommended enlargement to a sea-level canal 12 ft. deep and 90 ft. wide at the bottom, at a cost not to exceed $8,000,000, further deepening to 25 ft. at a cost of $4,500,000 to await results as to traffic.

It appears that a total tonnage, fairly well balanced, approximating 2,500,000 annually would be immediately available for this enlarged canal. Besides carrying more traffic than the present canal, a great saving would be effected by carrying in larger bulk. Coal, fertilizer, pig iron and forest products are the commodities most likely to be shipped in much larger quantities by a 25-ft. canal. Although enlargement to this depth would not permit the passage of the larger colliers now in use, it would carry the greater part of the bulk coastwise shipping. Further construction of full cargo coasters too large to pass through this canal, the New Jersey Ship Canal and the Cape Cod Canal would be discouraged, and in the course of time, when all such vessels had disappeared, coastwise freight would use the canal system almost exclusively.

Both the New Jersey Ship Canal and the enlarged Chesapeake and Delaware Canal are important to the Port of New York, and they should be considered jointly. They would reduce the distance by water from New York to Baltimore from 476 to 196 miles. During the decade from 1900 to 1909 disasters to shipping on the Atlantic seaboard are known to have destroyed $40,500,000 worth of vessels and cargo, an amount half great enough at that period to construct the entire intracoastal canal from Florida to Cape Cod, with ship dimensions from Cape Cod to Chesapeake

Bay. The average annual loss would have paid all maintenance and operating charges.

This intracostal canal system, constructed or enlarged to dimensions capable of passing large war vessels, would be of extreme utility in protecting cities and commerce along the coast. The destruction or occupation of any of our large Atlantic ports would work great harm to this country in depriving it of their products and commercial facilities. The canal system would provide facilities for rapid movement and concentration of our naval forces, without exposure to attack in the open field, and it would greatly lessen the danger of a surprise attack on any of the ports.

A project in which the State of New Jersey is concerned is the canalization of the Delaware River from Trenton to Phillipsburg and Easton. This improvement would have little influence on the traffic of the Port of New York.

GRAVESEND BAY–SHEEPSHEAD BAY CANAL

A needed adjunct to the development of Jamaica Bay is an inside and sheltered connection with the Upper Bay so that barges need not make the hazardous voyage through a considerable part of the Lower Bay. Such a channel can be provided by cutting a short canal through from Gravesend Bay to Sheepshead Bay, utilizing Coney Island Creek as far as possible.

A Board of Conference was created by the New York Legislature by Chapter 585 of the Laws of 1919 to study this question. Its personnel was the same as that of the Harlem River board. It has recommended the construction of a channel or canal at least 15 ft. deep, and with a bottom width of 250 ft. The Commission endorses the recommendations of this board.

OTHER LONG ISLAND CANALS

Other canals on Long Island have been advocated and surveys of several have been made. Among these are the Jamaica Bay-Flushing Bay, the Jamaica Bay-Peconic Bay, and the Newtown Creek-Flushing Bay canals. The first of these has been strongly urged and in 1914 the State Engineer and Surveyor investigated routes for such a canal. He estimated a cost of $12,592,574 for a sea-level canal 12 ft. deep and 75 ft. wide at the bottom. Such a canal, in conjunction with an improved Harlem River, would provide the shortest route for Barge Canal and other Hudson River traffic between the Hudson and Jamaica Bay.

At the same time the investigation of the Jamaica Bay-Flushing Bay Canal was made the State Engineer also looked into the desirability of a canal connecting Newtown Creek with Flushing Bay. He estimated that such a connection, 4¾ miles long, with 12-ft. depth and 75-ft. bottom width, would cost $5,894,144, to which, however, something would have to be added for deepening Flushing River and Bay.

The Jamaica Bay-Peconic Bay Canal would extend through the sounds on the south shore of Long Island from Rockaway Inlet to Shinnecock Bay and across the island to Peconic Bay, a distance of 75 miles. The project calls for a 12-ft. channel 100 ft. wide at the bottom.

Interior of Barge Canal Terminal — Pier 6, East River, Manhattan — Note Portable Tiering Machine and Trailers

CHAPTER 27

Freight-Handling Machinery

Freight-handling machinery to aid in the unloading and loading of general-cargo ships at the Port of New York will be justified, if at all, not so much by the cheaper handling of the cargo as by the increase in the speed of handling it — which will decrease the number of days the ship will be in port, increase the total number of trips it can make each year and increase the capacity of the Port by passing more tonnage annually over every pier properly designed and equipped. Obviously the field for the study of freight-handling machinery at this port extends beyond the mere unloading and loading of the ship itself, embracing operations incidental to this unloading and loading, and covers not only ships but floating craft of all kinds, and railroad cars. The machinery employed in the direct transfer of ship's cargo is mentioned particularly because on it depends the economical operation of the largest and most costly of transportation units.

There is a widespread opinion that the Port of New York is sadly lacking in machinery for unloading and loading ships and other floating craft; and that this lack of machinery has forced the operating companies to depend on obsolete methods of transfer, entailing great economic loss. Critics point to the cranes so conspicuous at the docks in Hamburg and other European ports, and then note their absence at New York, and the prevailing use of ship's gear, with its confusion of booms and cables, and seeming crudeness. The opinion is in the main unwarranted. In the first place, the cranes of the European ports are not used exclusively, as many assume; in the second place, the Port of New York has a vast waterfront, and scattered within its bounds is more freight-handling machinery than can be found in any other three salt-water ports in the United States, measured in terms of value, weight, extent or transfer capacity.

Denying therefore that the equipment of the Port is obsolete and grossly inadequate, the Commission concedes that in many respects it is not well balanced and correlated, and that the efficiency of the Port could be increased by the judicious installation of certain types of machinery at certain points, to serve certain definite purposes. The whole problem of freight-handling machinery is tied up to other problems, such as those of warehousing and the relation of the railroads. In general, however, the machinery installations desirable take four forms:

1. Cranes at many steamship piers, to supplement but not completely take the place of ship's gear in the handling of general cargo.
2. Machinery within the pier to facilitate the quick moving of goods to and from shipside, and within warehouses.
3. Better equipment to serve barges, particularly canal barges.
4. Special machinery at certain piers to handle large quantities of certain commodities in containers of uniform character and size.

In the study of the situation it was fully realized that the character of most existing piers at the Port limits the availability of machinery installation; and that the customs weighing requirements and the attitude of stevedores and longshoremen operate in the same direction.

How the Problem Was Analyzed

The problem of the needs of the Port was analyzed in three ways, as follows:

1. By a study, extending over more than a year, covering existing installations and their use, and the need for additional and more modern machinery and more modern methods.
2. By clockings and other minute studies of certain typical operations.
3. By a series of conferences with representatives of the principal freight-handling machinery manufacturers.

General Study — The problem was attacked from every angle — by visits to virtually all docking facilities within the Port and facilities connected with the transfer of cargo to and from ships, by time and other observations of certain operations, by interviews with men experienced in various phases of cargo transfer, by frequent consultation of publications relative to other ports, domestic and foreign.

Clockings — In addition to these general and detailed observations, clockings similar to those made at the railroad yards and terminals were made by the Commission's field forces. The discharging and loading operations of nine ships were thus clocked.

Further information as to the time, labor and other factors of typical transfer operations was derived from a study of available steamship records. The clockings and other studies of past operations were discussed at considerable length in Chapter 7 — "Shipping Facilities, Methods, Tonnages and Costs."

Conferences with Machinery Manufacturers — Late in 1918, when the German submarine warfare and the demands upon the United States to aid the world in its recovery from the war had brought home to all the need for making the best use possible of all shipping and shipping facilities available, some of the leading manufacturers of freight-handling machinery, at the instigation of the Port and Harbor Facilities Commission of the United States Shipping Board, formed the Material Handling Machinery Manufacturers' Association. The aim of this association was to apply the expert knowledge of its members to the working out of the best machinery or combinations of machinery to aid in all of the necessary operations connected with the loading and unloading of ships.

The New York, New Jersey Port and Harbor Development Commission felt that this association could assist it in its study of the Port of New York, that the viewpoint of the manufacturer should be sought before any conclusions were reached as to the use of machinery. A series of conferences, beginning in May, 1919, was held between the Commission's staff and a committee of the manufacturers' association — a committee made up of engineers experienced in the manufacture and use of such special machinery as cranes, conveyors, tractors, elevators and the like.

Invitations were sent by the secretary of the association to a large number of member and non-member manufacturers to submit their opinions as to the possibilities and limitations of their products in the performance of the various stages in transfer operations as outlined in a comprehensive cycle of operations developed at one of the conferences. The negotiations did not reach a point where the association as a whole made specific recommendations as to the best combinations of machinery to meet the requirements of the Port; but the Commission's engineering staff obtained many helpful suggestions, as well as drawings and specifications, from members of the association.

The study of the problem of freight-handling machinery has taken into account as far as the information was available the commodities to be handled, in their absolute and relative amounts, and the character, size and weight of packages; the existing trade routes, and number and kind of vessels serving each; the character of existing piers, and the difficulty of either constructing them or equipping them with certain types of machinery; the prevailing systems of stevedoring here and elsewhere; and many other conditions bearing upon the subject.

FOUR TRANSPORTATION AGENCIES

Freight-handling machinery requirements can best be considered in terms of the vessel or vehicle that transports the freight. These transportation agencies may be divided into four groups, as follows:

1. Transoceanic vessels.
2. Coastal, sound and river vessels.
3. Harbor and canal craft and barges in general.
4. Railroad cars.

The facilities for these classes do not necessarily differ, but overlap to a great extent. At the same time all have general characteristics which may be summarized briefly. Each class must be considered both from the standpoint of a quick transfer of the freight to or from another transportation unit, and from that of an intermediate resting place in transit shed or warehouse.

Transoceanic Vessels — Transoceanic vessels are the largest transportation units. Each unit represents a large investment which must necessarily be tied up for a considerable period while the vessel is being unloaded and loaded, and it is of prime importance that these periods of nonproductiveness be kept as short as possible. The vessel must be so arranged that unloading and loading operations can be conducted independently at a number of points.

From the standpoint of the transfer of cargo the characteristic feature of the transoceanic vessel is the hatch. Side openings in a ship that traverses the high seas are undesirable, and loading must be done through square or rectangular openings or hatches in the deck of the ship. The cargo is carried in the hold, which extends from the deck to the bottom of the vessel, far below. The ship is a self-contained, self-propelled unit, and much of its interior must be given over to engines, boilers, coal bunkers, quarters for the crew and other facilities required for the very running of the ship. On the large transatlantic vessels the passenger accommodations take another large part of the ship. A growing number of freighters carry no passengers, but probably a majority of all ships that enter the Port of New York have accommodations for at least a few passengers. The cargo-handling operations in port must be co-ordinated with the getting of passengers on and off and the loading of coal, food and other supplies for the next voyage.

The shape and size of the ship make machinery for loading and discharging a necessity. Many of the ships are "tramps," which run on no established schedule and must at times dock where there is no machinery. Consequently each ship is equipped with its own machinery for raising the cargo from the hold and transferring it to the pier or to a barge, or vice versa. Usually the machinery takes the form of masts, booms and tackle operated by power winches.

The chief characteristics of the transoceanic vessel, then, are deck openings or hatches necessitating vertical lifts of considerable distances; the provision of numerous hatches to permit simultaneous independent operations; the provision of machinery so the ship can load and discharge itself in the absence of other machinery; and the adaptation of the business of carrying freight, both in dock and in transit, to the needs of the vessel as a self-propelled entity carrying a considerable number of human beings.

Coastal, Sound and River Vessels — The second subdivision of containers embraces the side-port vessels, whether there are within the ship two or more freight decks, as in the case of the coastal vessels, or only one freight deck, as in the case of the smaller boats plying the rivers and Long Island Sound. Some vessels have both hatches and side ports.

Loading and discharging through side ports is totally different from the operations through hatches. Machinery is not essential and is little used, other than hand trucks and machines for "boosting" trucks up steep gangways. The vessel is still a large unit, and to expedite the turnaround there are usually several ports. Boilers, coal bunkers and accommodations for passengers and crew limit the cargo-carrying capacity of the vessel, but usually it operates on a close schedule, and the unloading and loading must be done expeditiously.

Barges — Harbor and Canal Craft — In the third group we have a variety of small craft, both self-propelled and non-self-propelled; some with handling tackle and some without. Although definitions vary somewhat in different parts of the harbor, those most commonly implied are as follows:

A lighter is a harbor vessel carrying her load on deck.

A steam lighter is a self-propelled lighter.

A derrick lighter is one fitted with a derrick and a steam or hand winch. Steam lighters are nearly all fitted with derricks and steam winches; some non-self-propelled lighters have steam winches, while others have only hand winches.

A barge is a non-self-propelled lighter having a deck house but no derrick.

A hold barge or box is a boat without power, and usually without a derrick, that carries her load in the hold. Such boxes are used in the main for carrying coal, grain and other bulk commodities.

In the matter of use the boats of this group comprise two classes — barges and canal boats in inland water service, and local craft used purely in transshipment. In either case the boat may dock alongside a pier where there are no facilities but her own for loading or unloading her cargo, or alongside an open railroad pier equipped with traveling cranes, or alongside a ship, where again her own equipment is superfluous, the ship's gear doing the work. Extra heavy freight that the ship's gear cannot handle is transferred on the offshore side of the ship by special steam lighters or floating derricks.

Lighters play an important part in the unloading and loading of ships. In many instances more than half of the transshipment is done on the offshore side of the ship to and from lighters, and it should be borne in mind that in such cases the most perfect machinery on the pier would not solve the problem of effecting a quick turnaround. On the other hand, with piers properly located with respect to the railroads, and designed to permit cars to be brought alongside the ship or upon the pier, it is conceivable that there would be less lightering, and the importance of having the best machinery on the pier would be correspondingly increased.

Vessels of the lighter and barge group represent individually a comparatively small investment, and usually demands for expedition in the loading and unloading of them are based not so much upon their earning power as upon the need for co-ordinating their movements with the operations of the ships and cars they serve. In this respect they differ from the vessels of the two preceding groups, and also from the railroad cars. All of these boats, with the exception of a comparatively small number used for warehousing grain, exist solely for the purpose of transporting freight, but considerable space is consumed by the living quarters of their limited crews if not by the housing of machinery and power facilities.

Freight Cars — Freight cars are the smallest units of all. They are essentially containers, with no waste space and presenting no intricate problem of proper loading, but of course devoid of facilities of their own for handling the freight. General merchandise, furthermore, is carried in box cars to protect it against the weather, and it is more difficult to work with machinery into and out of such cars than into and out of open cars.

The majority of the railroads of the Port have lighterage piers on which the cars are run to afford direct connection with boats. Few of them accommodate ships, however, and of those that do the tracks are mainly within the pier shed so that direct transfer between car and ship would be impossible with any ordinary machinery. Nearly all transshipment in New York Harbor between car and ship is through the medium of lighters. At the railroad piers hand trucks effect the transfer of the general freight, while heavy or bulky freight is transferred at special open piers, usually equipped with traveling cranes. Ship's gear, as already stated, usually effects the transfer at shipside.

There are some instances of the cars being taken alongside the ship on car floats, the commodities transferred usually being refrigerated meat, or bananas. On the other hand, there is a considerable volume of lightered railroad freight destined for or originating at the Port and having no connection with shipping — heavy, inflammable or other local freight that cannot well be handled at the railroad pier stations.

The foregoing outlines do not take into account car dumpers, grain elevators, stationery or floating, or other special facilities for handling individual commodities in large quantities. They will be discussed later.

THE PORT'S EXISTING FREIGHT-HANDLING EQUIPMENT

The points where the four foregoing classes of freight containers unload and load are scattered over a waterfront of 800 miles, and a considerable area inland with respect to the freight cars. The equipment for facilitating the unloading and loading is meager in some respects, abundant in others. The truth of this generality, the difficulty of being more specific at this point, will be brought out in the discussion one by one, later in this chapter, of the different transshipment operations carried on in the Port. In the aggregate, however, this equipment reaches large proportions.

The equipment may be divided into two groups — agencies for the transfer of cargo from one type of container to another, and those for the transportation of goods from point to point. Because of the peculiar conditions at the Port, the two groups merge at various points, and no sharp line can be drawn between them. For example, high-capacity floating cranes are primarily agencies for the transfer of heavy machinery or other heavy weights to and from ships, and they carry their own machinery for handling their loads over the ship's sides as the ship's own equipment could not economically do, yet they are transportation agencies as well. On the other hand, derrick lighters are primarily transportation agencies, despite the derricks they carry to facilitate their own loading. A line also has to be drawn somewhere between the motor truck or dray which is the transportation agency of the street and the power truck which is part of the freight-handling equipment of the pier or warehouse.

In the first group we find gantry and locomotive wharf cranes, floating cranes, floating grain elevators, cargo masts, electric tractors, trailers and trucks, truck cranes, vertical and inclined portable conveyors and tiering machines, besides stationary grain elevators and coal trestles, car dumpers and other plant for handling special commodities in large quantities. In the second group come the great fleet of tugboats, lighters, car floats, barges and other harbor craft that distinguish New York from every other port in the world.

Transoceanic Ships

Transoceanic ships, representing individually the largest investment, the greatest earning power and the greatest economic losses if inefficient transfer methods are used of the four principal groups of freight containers, present the first problem of freight-handling machinery.

Importance of a Quick Turnaround

Overshadowing almost every other consideration is the need for a quick turnaround of the vessel. It is stated that about twenty days are required to unload and reload the average freight vessel of 4,000 net tons. Charter values of vessels fluctuate widely, but whether the average value be $1,000 or $4,000 per day — and the present range is well within these figures — a reduction of one-half in the time of discharging and loading would effect a great saving. At the $1,000 rate the saving would be $10,000, the interest on $200,000; at the $4,000 rate, four times these figures. Considering the number of dockings in a year at one berth and the number of berths at a pier, it is apparent that whichever set of figures is more nearly in accord with average conditions, high first cost need not bar the installation of the machinery necessary to effect a quick turnaround.

At the Port of New York the operator of the ship would not be the only beneficiary of a quick turnaround. Shipping interests are crying for space, and there is danger that they may go to other ports if they cannot be accommodated here. Cutting the average turnaround in half would double the capacity of each pier, provided the pier and upland facilities could handle the cargo rapidly enough, and the tonnage were available, and the danger of loss of commerce would be greatly lessened.

Ship's Gear — Burtoning

Study of the problem of handling freight to and from the transoceanic ship should begin with an examination of the ship's own equipment. Machinery is imperative, as already pointed out, for the loading and unloading of such ships through their hatches, and virtually all of them have their own gear in the shape of masts, booms and power-driven tackle. For the three-way movement of loading, vertically up from the pier to the ship's deck, horizontally to the hatch and vertically down to the ship's hold — unloading following the same course in reverse order — there has long been in use a method known as "burtoning." When burtoning is performed by ship's gear alone the procedure is as follows:

There must be at least two booms accessible to one hatch (unless the objectionable practice of dragging the load over the ship's side is followed). Assume that the ship is loading from the pier. One boom is set and held so that the end is vertically over the hatch. The other, in a lower position, reaches beyond the side of the vessel to a point vertically over a spot on the pier where "drafts" are being assembled. A draft in this connection is a load for the ship's gear, consisting of one or more packages, aggregating about a ton in weight, that can be held together in air by means of a sling or some other container. Each boom has its separate hoist, consisting of a rope controlled by a winch and run through a block at the end of the boom. The free end of each line is attached to the sling. The draft is pulled up wholly by the line on the boom over the pier, while the other line is kept loose until the draft is sufficiently above the level of the deck. Then the second line is drawn taut and pulled in as the first is paid out in such manner that the draft follows substantially a horizontal course until it is over the hatch. The first line is then slackened and the draft is lowered solely by the second line. In the hold the hooks are released and taken back for another draft. Skillful operators virtually merge the three operations through which the load passes, and the entire cycle is performed in less time than is required to describe it.

Obviously the use of ship's gear requires a considerable amount of labor. In loading there must be men on the pier to bring freight to the point where it is taken over the side of the ship (the number depending on the distribution of the goods on the pier), from four to six men at that point to assemble the packages into drafts that can be handled in a sling, a signalman on deck, an operator for each winch or line and a gang of from eight to twelve men in the hold to release the hooks and stow the goods. About the same gangs are needed for unloading. Much of the work at the Port of New York is done by stevedoring companies under contract.

There are numerous possible modifications of the above-described method of burtoning which need not be set forth here, as they all involve the same general principles. The process is carried on in substantially the same manner on the offshore side of the ship to

Derrick Lighter and Floating Derrick for Lifting Heavy Weights — Alongside Gulf Liner

Lighters, Derrick Lighters, Barges, Hold Barges and Floating Grain Elevator at Work in Slip Alongside Steamships — Note Cargo Masts on Pier and Simultaneous Loading of Each Side of Ship

and from lighters. In fact, with a sufficient equipment of ship's tackle, and large enough hatches, operations can be carried on simultaneously on both sides of the ship.

NUMBER AND ARRANGEMENT OF HATCHES, MASTS, BOOMS AND WINCHES

Because of the fouling of lines it is not ordinarily feasible to work with two pairs of booms from one mast over one hatch on one side of the ship, but one pair can be worked on the shore side and one on the off side if the hatch is large enough. The rate at which a ship can be unloaded and reloaded with ship's gear depends much on the number and arrangement of hatches, masts, booms and winches. A common type of vessel has four hatches, two masts, eight booms and eight winches, with the hatches in pairs and the masts between pairs so that each boom and each winch can serve either of two hatches. Each hook — that is, each separate burtoning operation — requires the use of two booms, consequently there can be only four hooks working, or the equivalent of one for each hatch. Considering such a ship as a whole, there is no advantage in time in loading from both sides.

A few of the four-hatch two-masted ships have more tackle than this; some of them have sixteen booms and sixteen winches — eight of each to the mast. With such equipment it is possible to work a hook on the shore side and one on the off side in each hatch if the hatch is large enough. Hatches range in size from about 15 x 15 ft. to as large as 30 x 40 ft., and where rectangular the long dimension may run either longitudinally or transversely with the boat. Simultaneous operations on both sides of the ship can be carried on best when the long dimensions of the hatches are athwartship.

Numerous arrangements of hatches and masts are found. Some of the largest transatlantic vessels have seven or eight hatches. One type of freighter, built with the engine aft and with clear space between the bow and stern superstructures, has a system of hatches and masts on each side of the ship, making a total of eight hatches in four transverse pairs, and ten masts in all, with thirty-two booms and thirty-two winches. With such an arrangement eight hooks — two to a hatch — can be worked on each side simultaneously. In general, if there is to be simultaneous working from both sides of the vessel to the full capacity of each hatch, with sole dependence on the ship's tackle, there must be four times as many booms as hatches.

CARGO MASTS

What has come to be virtually a standard feature of New York steamship pier design, though little found elsewhere, is what is inadequately called the cargo mast or cargo hoist. This consists of a row of masts on line with the side columns of the pier shed, and girders or cables connecting the tops of the masts. Irrespective of the height of the pier shed, the masts rise to an elevation of about 80 ft. above the water level, so that the cross girders or cables are well above the side of the highest ship. In conjunction with the cargo masts there are usually electric winches on the pier.

The sole purpose of the cargo mast is to support pulley blocks and release half of the ship's booms used in the unloading and loading operations on the pier side — the half that would otherwise be guyed to overhang the pier. Pulley blocks can be attached to the horizontal girders or cables of the hoist at any point, and with one such block and line and one ship's boom with its equipment, burtoning can be carried on exactly as with two of the ship's booms.

There are three principal advantages of cargo masts — they release some of the ship's booms for other work, they give the transferring operations greater flexibility and make it possible to work to and from a somewhat larger part of the pier's edge, and they overcome the difficulties imposed by the practice of breasting off.

With respect to the first-named advantage, consider the ordinary four-hatch, two-mast, eight-boom and eight-winch vessel. We have seen that only the equivalent of one hook per hatch can be worked with the ship's gear alone, working on one side or both sides, although it is perfectly feasible to work a hook in each hatch on each side if the hatch is large enough. Using the cargo mast, one hook can be worked in each hatch on the pier side and still leave four booms available for offshore work, and the four can work two more hooks.

As to the greater flexibility, it is apparent that where the ship's booms, with their limited reach, are the sole reliance, the drafts must be assembled at or lowered upon spots on the pier more nearly opposite the hatches than where cargo masts are available.

Breasting off is a common practice resorted to at New York piers. It consists of moving the ship laterally away from the pier far enough so coal barges can come between the pier and the ship. This makes it possible to coal the ship on both sides and keep it trimmed. This is a necessary procedure, but it renders the ordinary ship's gear useless unless assisted by cargo masts, because the ship's booms will not reach to the pier. The combination of ship's gear and cargo masts readily bridges the gap between pier and ship, and with only a slight increase in the length of the cycle, for the raising and lowering of the draft take longer than the horizontal movement. At piers where there are no cargo masts, however, it is possible by rigging temporary booms, either on the pier or on the ship, to accomplish the same results as with cargo masts.

Evidently cargo masts are of no service in loading and unloading operations on the offshore side of the ship except as they release ship's gear that can be used on that side, and it should be repeated that the greater part of many cargoes is handled by lighters on the offshore side.

CRANES

Aside from facilities for handling special commodities, such as coal, grain and ore, in large quantities, cranes are the only kind of machinery available to any extent in the Port at present for the specific work of unloading and loading ships with hatches. The cranes available are the revolving, conveyor and locomotive cranes on open railroad piers on the New Jersey waterfront, and the floating cranes. The pier cranes are described more fully on page 397 of this chapter. Although many of them could be used in the direct loading and unloading of ships, they are not except to a negligible degree.

Floating cranes constitute an important part of the Port's equipment for serving transoceanic ships. Heavy freight that cannot be handled by ship's gear is floated to or from the ship's side either on a barge or on the deck of the crane itself, and the crane performs the transferring operation over the side of the ship and through the hatch of the hold. The weights of drafts handled by ship's tackle ordinarily do not exceed 3,000 lb., and the capacities of the floating cranes range from that minimum to 150 tons.

Except for several floating cranes owned by the City of New York, all equipment of this character in the harbor is owned by private companies. The largest of these companies owns about twenty-four cranes — one of 150 tons capacity, one of 80 tons, one of 55, one of 50 and the others ranging down to 8 tons. The cranes are carried on hulls of various sizes up to 147 x 50 feet. Only a few of the smallest are self-propelled. The cranes are rented by the day, the hour or the lift.

MOVING GOODS TO AND FROM SHIPSIDE

We have seen that freight handled on the offshore side of the ship comes and goes on lighters and barges and is handled over the ship's side by the ship's own tackle or by floating cranes. How the goods are got on and off the small boats at the other end of the local voyage is discussed in the section relating to small craft, page 393.

An important consideration in the operation of a steamship pier is the means of getting the goods to and from the ship's side without delaying the ship or hampering the operation of the ship's gear. Transatlantic liners remain in port only a few days. Ships in the Far Eastern trade, calling at a number of ports, may be here three weeks or more. In either case the ship is earning nothing while in port, and every effort must be bent to keep this idle time down to a minimum. The goods discharged from the ship must be got out of the way not only of those that follow them from the ship but of goods brought to the pier to be loaded upon the ship.

The outgoing cargo presents the greater problem, because of the complexity of loading a ship properly. The goods must be so placed in the hold as to trim the ship and keep her seaworthy, consideration must be given to the protection of fragile goods from breakage and of food and other high-class products from contamination, and if the ship is to touch at several ports the cargo must be so placed that that for the ports first reached can be moved without disturbing the remainder. This means that the contents of the ship must be known in advance, a loading plan must be made, and in general the entire cargo must be at hand when loading starts.

There is practically no machinery other than hand trucks to be found on New York piers for transoceanic vessels to facilitate this movement of the goods within the pier. There is a growing use of electric trucks and trailers, but their use is confined mostly to the piers of the coastal, river and sound steamers, where a quick turnaround of the vessel is imperative, where the trucks can be run through the boat's side ports, and where the operation is not complicated by customs weighing.

A considerable part of the outgoing freight handled by lighters is brought to the pier before the ship arrives, and is discharged upon the pier; and similarly much incoming cargo is discharged upon the pier and subsequently removed by lighter. This adds to the congestion and storage problem of the pier, which is later discussed more fully.

ADDITIONAL EQUIPMENT NEEDED

Summarizing, cargo of transoceanic ships is handled on and off the ship at the Port of New York in two ways — on the pier side with ship's gear with or without the aid of cargo masts, on the water side with ship's gear alone, or with floating cranes in the case of heavy freight. Lighters and barges move the goods to and from the ship on the water side. Hand trucks do most of the work within the pier. A large part of the cargo is handled on the water side, but except in the case of munitions shipped during the recent war there has been little loading or unloading in the stream during the last fifty years.

The questions that present themselves are, Are present equipment and methods of operation satisfactory as they stand, are they so unsatisfactory as to call for something entirely different, or can they be utilized in conjunction with additional equipment? The Commission believes the third course best for the Port of New York. It believes that cranes of moderate capacity should ultimately be found on most piers that handle general cargo, that new piers for general cargo should be designed to carry them and to facilitate their operation, and that the piers should be equipped with electric tractors and trailers and other devices to facilitate rapid movement of the goods within the pier. Elsewhere in this report the Commission discusses a zoning system for shipping, and suggests that for certain trade routes and commodities piers can be so located, constructed and equipped that railroad cars can be brought alongside the ship for direct transfer of freight. Lines which by reason of the nature of commodities carried, excellence of freight-handling equipment on the ship or some other controlling factor can utilize the best of the present type ot pier to advantage should be allocated to them.

With cranes available, ship's gear would continue an important agency on the wharf side and the chief agency on the offshore side for transferring cargo, but the cranes could perform the same sort of service on the wharf side; could work in part cycles in team with some of the ship's tackle in a manner later explained; could transfer heavier loads than the ship's tackle could handle, and could transfer goods between lighter and wharf before the arrival of the ship and after its departure. The electric tractors and trailers, meanwhile, would keep the goods on the pier properly distributed and prevent loss of time to the ship through congestion on the pier.

The majority of New York's present piers have no railroad connections. The majority are far too narrow. The majority of the pier sheds are built practically to the edge of the pier, leaving room for neither railroad tracks, traveling cranes nor even adequate working spaces for any kind of tackle. It would be folly to attempt to install elaborate machinery on piers not suited to its unhampered operation, and on the other hand the large number of existing piers cannot be thrown at once upon the scrapheap. As a general policy the Commission recommends the building of new piers of such dimensions and design as will accommodate the requisite modern machinery, the installation of whatever is suitable for the existing piers, and the gradual replacement of most of these piers by wider and more modern structures, or their assignment to uses for which they are adequate.

CRANES — DEFINITION OF TERMS

Before taking up the question which will naturally be asked, why both pier cranes and ship's gear are recommended, it will be well to consider briefly the types of cranes available for general-cargo piers, mainly as exemplified by certain of the foreign ports; and in order to make clear the distinctions in the different types, the following definitions have been prepared:

A *crane* is a machine for raising and lowering heavy objects, and moving them laterally through a short distance. It has two essential motions, lifting and transporting.

A *fixed crane* is one which works from a fixed position.

A *traveling crane* is one which can move itself or be moved bodily, usually on a track.

A *gantry* is a horizontal bridge or girder supported by uprights, or legs, sometimes fixed, but in harbor practice usually mounted on wheels running on a track, giving the structure motion normal to its length.

A *crab* as a part of a crane is a winch on a carriage or trolley which traverses an overhead track.

A *gantry crane* is any combination of a crane or crab and a gantry.

A *revolving crane* is a crane, fixed or traveling, with a jib or boom carried by a body which revolves about a vertical axis. The jib may be fixed or hinged at the base. The load is raised or lowered from the end of the jib through ropes, cables or chains passing around the pulleys and controlled by a rotary drum.

A *portal crane* is a revolving crane mounted on a gantry whose legs are equal in length, both sets of track rails being at the same level.

A *semi-portal crane* differs from a portal crane in that the legs are unequal in length, the two sets of track rails being at different levels. The lower rail is usually at the wharf structure, the upper rail attached to the wharf shed above the doors.

A *conveyor or straight-line crane* is a combination of a crab and a gantry, usually with a projecting arm at one or both ends. These extensions may be fixed, hinged or receding.

A *locomotive crane* is a revolving crane carried on a car running on a two-rail track, usually an ordinary railroad track.

Traveling is the bodily motion of a traveling crane.

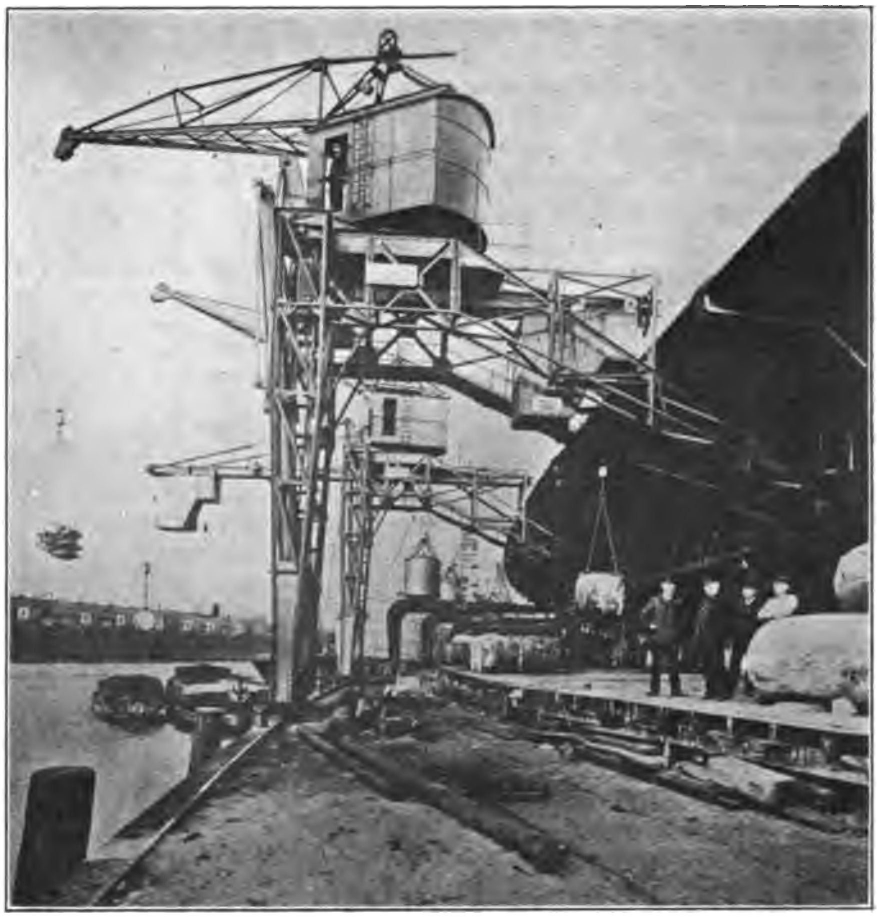
Traversing is the lateral motion of a crab or the revolving unit of a gantry crane.

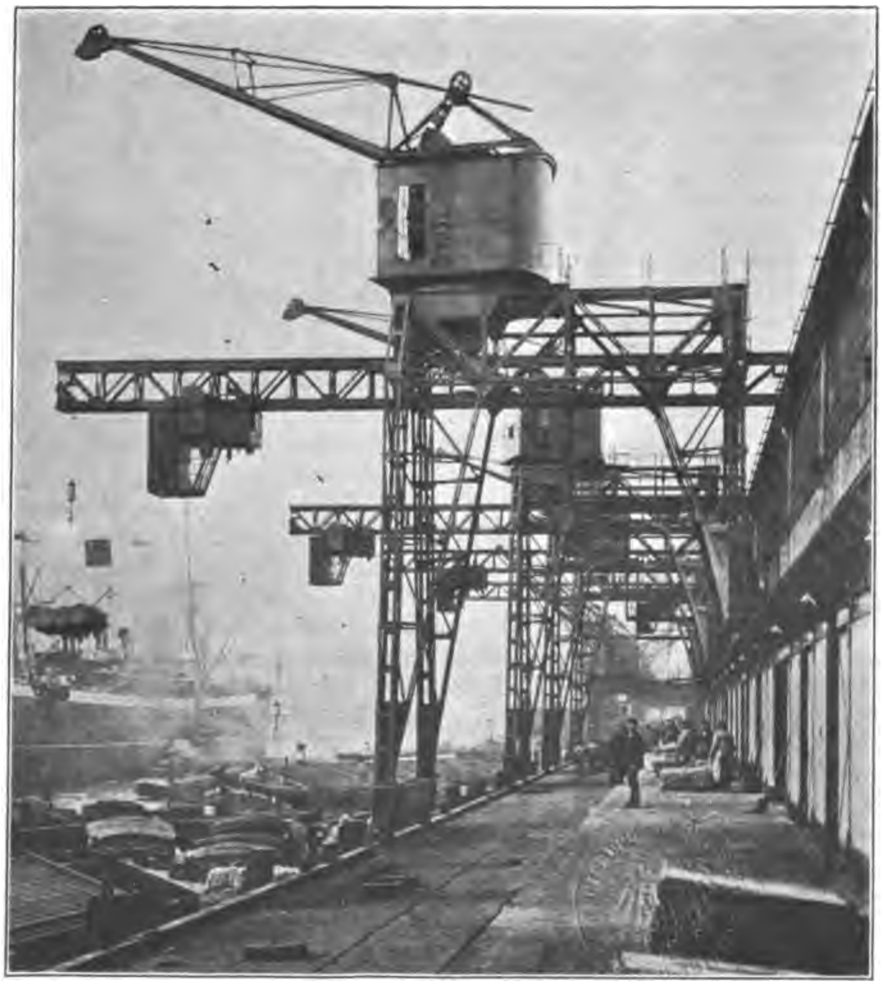
Slewing is the swinging or revolving motion of a revolving crane.

Luffing is the motion in a vertical plane of a hinged jib or conveyor arm.

GENERAL CHARACTERISTICS OF WHARF CRANES

Revolving cranes and straight-line cranes are the two main types of wharf cranes, virtually all wharf cranes falling in one class or the other. Revolving cranes are of many kinds, and may have any or all of four different kinds of motion — (1) traveling, (2) slewing, (3) luffing and (4) vertical motion through the lines on the boom (hoisting and lowering). Occasionally the revolving superstructure also has a traversing motion on the substructure. Straight-line cranes, though less numerous and of less variety than revolving cranes, may be capable of four kinds of motion — (1) traveling, (2) either lateral or luffing motion of the conveyor arm, (3) traversing of the crab and (4) vertical motion through the lines on the crab (hoisting and lowering). In its ordinary transshipment operations the load of the straight-line crane travels in a vertical plane — up, across and down — hence the designation of the crane.



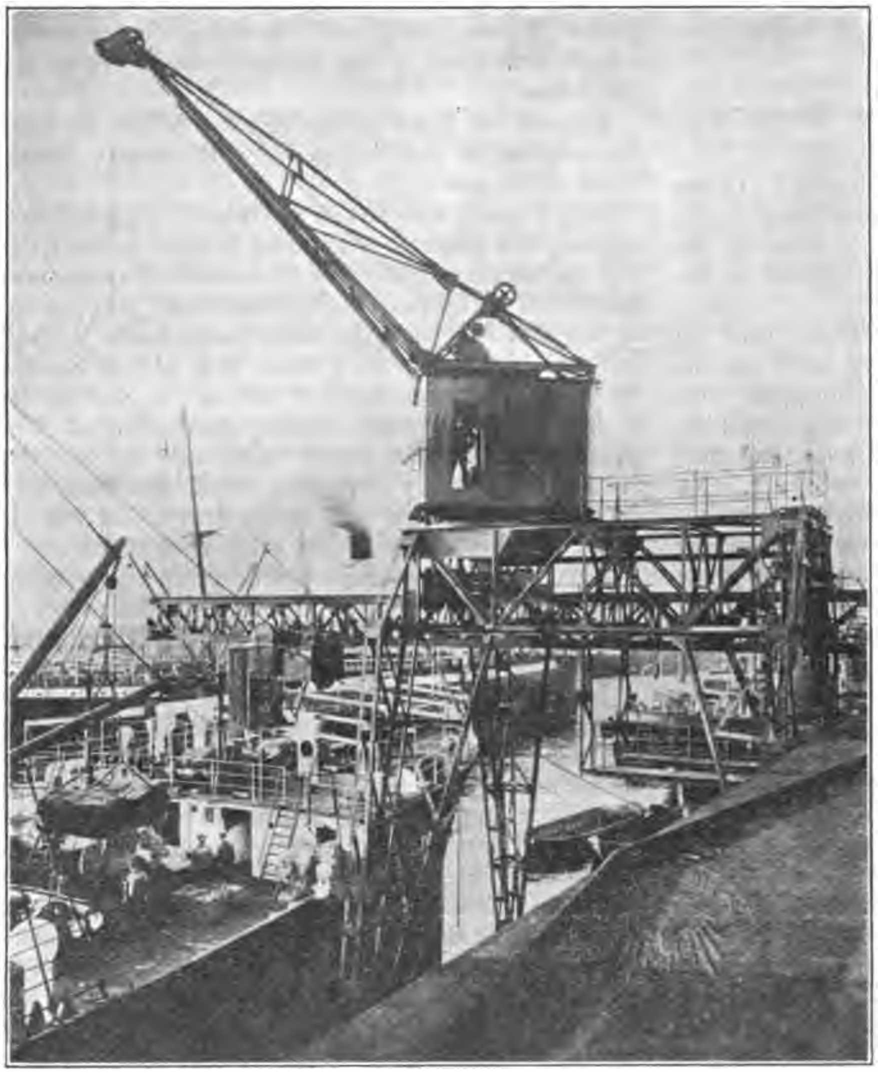


Combination Semi-Portal Crane at the Port of Hamburg; Revolving and Straight Cranes Mounted on Same Substructure

Wharf cranes of either the revolving or the straight-line type are fitted to various arrangements of pier and pier shed. If there is sufficient space between the shed and the dock, portal cranes can be used, spanning one, two or even more railroad tracks. If this space is limited, or if for any reason it is desired to keep the space immediately adjacent to the shed entirely unobstructed, the gantries can be of the semi-portal type, with the inner leg carried on the roof. In some instances the entire crane is carried on the roof. The three requirements for the traveling crane, none of which is met at the average New York pier, are: (1) That the pier or shed be strong enough to carry the crane loads, (2) that there be sufficient space between dock and shed and sufficient number and size of door openings to permit the crane to operate freely, and (3) that the shed be sufficiently wide to handle the goods within the shed and keep pace with the crane.

TYPES OF WHARF CRANES AT FOREIGN PORTS

The type of crane common to such ports as Rotterdam, Antwerp and Hamburg, which are frequently cited as showing the backwardness of the Port of New York in the matter of cargo-handling machinery, is a traveling revolving crane with a high substructure. The prevailing capacity is about two tons, although the present tendency is toward a greater capacity. Each crane requires about 80 ft. of wharf space when swinging in only one direction.



Combination Semi-Portal Revolving and Straight-Line Crane Working in Team with Ship's Gear at Port of Hamburg

Some large recent installations, such as the Holland-American at Rotterdam, utilize straight-line cranes, while the latest type at Hamburg has both a revolving unit and a straight-line unit, working separately.

At some of the European ports these imposing looking cranes dot the waterfront, as many as 134 being found on a quay line. Two of the appended photographs give a conception of the appearance of the port of Hamburg.

CONDITIONS OF OPERATION

In many respects the conditions at these foreign ports are quite different from those obtaining at the Port of New York. Box cars are not used. The wharves are mostly of the quay type, parallel to the shore line instead of jutting out into the water, and there is usually space enough available so that the freight sheds and warehouses can be set back some distance from the water's edge, the intervening space being kept open except for craneways and railroad tracks.

This condition adds greatly to the utility of the crane. Cars can be run to the ship side and direct transfer between car and ship made by the cranes, while the percentage of the lightered freight, which has to be handled largely by ship's tackle, is somewhat reduced. (There is, however, in many of the European ports a large amount of direct transfer between ships and the barges that operate on the extensive canal systems; and as much of this as is transferred directly between ship and barge or lighter is handled with ship's gear.) The prevailing open space between shed and water, too, gives the crane the opportunity to maneuver, receiving and discharging drafts at various points on the wharf, which is one of the advantages the crane has over ship's tackle. The cranes are also very serviceable for making transfers between the wharf and harbor craft when no ship is in the dock.

Nearly all of the striking installations in European ports have been put in by the state or municipality, and it is by no means certain that the steamship companies would install them at their private wharves. At any rate the piers in Hoboken built not many years ago for their own occupancy by certain of the German and Dutch companies that had the use of the most modern cranes in Europe have no cranes. Nor are all of the European cranes utilized to their fullest extent; in some instances ship's tackle is the main reliance at wharves provided with cranes.

While the European cranes are used largely for transferring cargo directly to and from the hold of the vessel, the jibs of many of them have too short an outreach to accomplish this with some of the ships, and a combination — crane transfer between the wharf and the deck of the ship, and the use of ship's gear between the deck and the hold — is used. Even where the jib has an ample reach it is frequently found expedient to keep them luffed up high and use the ship's gear in team with the crane. The photograph of one of the latest installations in Hamburg, the combination revolving and straight-line crane, shows it operating in that manner, one ship's boom serving the revolving unit and another the conveyor-arm unit.

It is not the Commission's purpose to explain the comparative lack of wharf cranes in the Port of New York by discrediting the installations in European and other foreign ports. There is ample reason to believe that the foreign installations are in most instances very effective, and in large measure the arguments for them are applicable at the Port of New York. But the conditions at New York are somewhat different from those anywhere else, and her specific needs must be worked out to fit those conditions.

WHY NEW YORK NEEDS BOTH PIER CRANES AND SHIP'S GEAR

What, then, are New York's specific needs? Is the Commission proposing duplication of machinery? To answer these questions it is necessary to examine the advantages and limitations of both as applied to the conditions of the port.

Ship's Gear—Its Advantages—Ship's gear is standardized equipment. Almost every ship has it, to enable it to operate in ports not equipped with cargo-handling machinery. Its use is understood by stevedores and longshoremen the world over, and they can rig it quickly and operate it with certainty. No very high intelligence or skill is required to manipulate the winches, and in fact the entire transferring operation can be performed with an ordinary grade of labor, and without conflict with labor-union restrictions. If the ship's crew is available at the port, it can readily operate the ship's gear.

The gear is equally adapted to operating on the pier side, on the off side or in the stream. The winches derive their power from the ship's own boilers. Working in conjunction with cargo masts, ship's gear operates with little loss of time while the ship is breasted off from the pier. One or more booms can be "spotted" over each hatch, and so there is no loss of time in finding the opening to the hold with each successive draft. The relatively small draft is more easily handled in the hold than a larger one would be.

Disadvantages of Ship's Gear—The first disadvantage of ship's gear is the lack of enough of it on the average ship. We have seen that in order to work all hatches to full capacity there should be about four booms and winches per hatch. Yet few ships have this proportion, and many have no more booms than hatches.

The efficiency of ship's-gear operations depends in large measure on the condition of the winches, and they are chronically in bad condition. Repairs cannot be made without loss of valuable time while the ship is in dock, because the equipment is needed for handling cargo; while it is difficult to make them at sea. Furthermore, stevedoring is done largely by contract at the Port of New York, and the ship's crew has no incentive to maintain the winches in good condition for other users. Even though the crews of foreign vessels are hired on the other side of the ocean for the round trip, and so can be called upon to unload and load the ship at this port, they do not ordinarily, as is frequently asserted, take part in either operation, whether because they have other duties here in the care of the ship, or because of the conflict with labor-union rules.

While ship's gear can be operated with ordinary labor, such labor is usually inefficient, and the burtoning process, requiring as it does synchronizing of effort on the pier, on the deck and in the hold, without as high a grade of labor and supervision as is likely to accompany crane operations, can easily be slowed down by an insufficiency of men at one point, or by failure of some of the men to do their part. The contract system of stevedoring, while it makes for economy in certain directions, is not generally conducive to rapid operations.

Keeping up steam in one or more boilers to operate the winches is very expensive with certain types of boiler equipment.

Ship's masts and booms are placed adjacent to the hatches, and where they are used in pairs in the burtoning operation, without the assistance of cargo masts, the line of travel must be approximately perpendicular to the axis of the ship. This reduces the accessible frontage of the pier to a small part of that alongside the ship, and unless the pier shed has continuous doors it is further reduced, causing congestion at a few points. Cargo masts partly relieve this by permitting burtoning obliquely from the hatch, but only to the degree that a straight line can be drawn that will clear all of the ship's rigging and other obstructions.

Finally, in however good order ship's gear may be maintained and however efficient the labor may be that uses it, it is idle probably from sixty to seventy-five per cent of the time, while the ship is at sea. It is held elsewhere in this discussion that many ships are inadequately equipped with gear to work without the aid of wharf machinery. But ships on certain trade routes may touch only ports that have such machinery, and if in the future the equipping of such ships with winches and other gear idle this large percentage of time can be in part dispensed with in favor of wharf machinery that can be kept at work most of the time at no greater cost per ton of cargo handled, a material saving will be effected.

Advantages of Wharf Cranes—In the wharf crane we have a single machine that can take a load from the pier and deposit it on the pier, all with control by one man at the machine. The crane is ordinarily designed for a larger load than ship's gear can handle, and usually two cranes can be worked together to handle loads of double the capacity of the single draft. The traveling crane can reach almost the entire frontage of the wharf, and even without recourse to the longitudinal travel the revolving crane, through its slewing and luffing action, can reach a considerable area of the pier and is not restricted to a certain spot, as is usually the case with the ship's gear. Revolving cranes are also clear of the hatch when not handling a draft through it, and so do not interfere with other operations through the same hatch. The straight-line crane, on the other hand, can reach well in on the pier and can operate without danger of conflict with the ship's rigging. Both types release ship's gear for use on the offshore side of the boat, in loading and unloading lighters.

Cranes need not be idle while the ship is at sea. They can work on one ship after another as continuously as ships can be berthed at the wharf, and between ships they can be employed in the transfer of cargo between small craft and the wharf, or in the loading and unloading of heavy freight on cars on the wharf. They can be utilized also in transferring freight from one part of the wharf to another, and so can be kept earning money on the investment most of the time.

Cranes, being more expensive and complex machines than ship's gear, and being always at one site where the responsibility for them is more definite, are likely to be better maintained than the ship's gear. A higher grade of operator is required for the crane, and this usually results in greater efficiency of operation.

Disadvantages of Wharf Cranes— Wharf cranes, as already pointed out, are feasible only on wharves and transit sheds strong enough to carry them, and so laid out as to permit free operation on the pier. Even then the cranes are restricted in their operation over the ship's side by the rigging and other parts of the ship. The various motions of the revolving crane allow considerable maneuvering in avoiding these obstructions, but skillful operation is required to avoid collision with them, and the cycle of the crane does not differ much in length from that of ship's tackle. The straightline crane held stationary opposite the hatch avoids this conflict with the ship's rigging, but its area of control on the wharf is then reduced to about that of ship's tackle, except that it may reach farther in from the water.

Wharf cranes are useless in the direct transfer of freight between lighter and ship, which constitutes so large a part of the whole at the Port of New York. Their arms are also frequently too short to reach the hatches of some of the vessels, particularly if the vessel is breasted off to receive coal. If they can reach the hatch full-capacity drafts are likely to be harder to handle in the limited space in the hold than the smaller ship's-gear drafts; or the hatches may themselves be too small to allow the drafts to be safely passed through them. There is also a limit to the number of small packages that can be made into a draft to be carried in a ship without danger of crushing or collapse — a limit which is often below the capacity of the ship's gear. All of these restrictions on the load are to the disadvantage of the crane, tending to force it to work at less than its capacity.

Cranes introduce a labor difficulty in that a higher grade of ability is required to operate them than to perform the other longshoreman duties.

The first and maintenance costs of cranes, the added strength needed in their supporting structures, and the extra width of pier required for efficient operation of the cranes are heavy burdens against the cargo-handling operations, and are sheer additions, inasmuch as ships must probably always carry some equipment of masts, booms and winches. It is evident, therefore, that every effort should be made to keep the cranes on work for which they are specially fitted, rather than on work ship's tackle can handle as well, such as raising and lowering drafts through the hatches.

Wharf Cranes and Ship's Gear in Combination— Considering the foregoing advantages and limitations of ship's gear and wharf cranes, the Commission believes that both should be available to promote the most rapid discharging and loading of the average cargo carrier. The main objective is a maximum volume of weight or cargo through the hatch, or as nearly a maximum as can be handled in the hold. This maximum, which may mean three or four hooks through the hatches of vessels adapted to them, cannot, in many cases, be attained through ship's gear to the exclusion of cranes or cranes to the exclusion of ship's gear. On the one hand the large number of booms required, especially if there are no cargo masts on the wharf, on the other the operation of even two cranes closely enough together to serve one hatch, will ordinarily cause interference.

A certain minimum amount of ship's gear is necessary in order that the ships may discharge and load at ports having no wharf machinery and in order that they may handle goods on the offshore side to and from lighters. The average ship cannot be said to have more than such minimum amount. Relatively few have more than enough without extraneous assistance to work one hook per hatch on the wharf side and one per hatch on the off side. In a large percentage of ships a crane could work in some at least of the hatches without interference with any of the ship's booms. It would be more economical to invest in cranes for this purpose that could be kept at work substantially all of the time, than in further ship's tackle that would be idle two-thirds of the time. Cranes can be added to a wharf from time to time as traffic warrants, the need for additional cranes being proved before they are installed.

In support of the contention that the average ship has not enough tackle to load or discharge to the full capacity of the hatches or the stowing and breaking-down operations in the hold, the accompanying table is presented to show the equipment of four ships of about equal tonnage observed last year in the Port. Assuming that these ships are to be operated at piers equipped only with cargo masts and pier winches, and also that one third of the freight will be handled off side — that is, direct between ship and lighter — it will be noted: That ship *A* can work only four hooks on the wharf side and two hooks on the off side simultaneously, while four of the hatches must be idle; that ships *B* and *D*, though able to work all of their hatches at one time, can work only six hooks on the wharf side and three on the off side simultaneously, three of the hatches being served by only one hook each; and that ship *C* can work twenty hooks on the wharf side and nine on the off side simultaneously, seven of the hatches being served by three hooks and two by four hooks.

CARGO-HANDLING EQUIPMENT OF FOUR STEAMSHIPS

Designation	Flag	Net tonnage	Hatches	Masts	Booms	Winches
A	American	3,354	8	2	8	8
B	Italian	3,643	6	6	12	12
C	British	3,908	9	10	38	16
D	British	2,878	6	6	12	7

The layouts of the ships in question are such that cranes could be used effectively to assist on at least three of them.

SAVING IN SHIP'S TURNAROUND POSSIBLE

Evidently this simultaneous working of ship's gear and cranes would effect a saving in ship's time, but without improved layout and provision of ample transit floor space the benefits of cranes would not fully materialize. With such provisions, together with adequate regulation to insure deliveries of goods to and removal from the pier at the proper times, it seems conservative to say that the present average time of discharging and reloading can be cut in two.

Twenty days is about the average time required under present conditions at the Port of New York for ships of the capacity of these four for the two operations of discharging and loading. Less than one-fifth of the total time the ship is at the pier is actually used in working the hatches. Support for this statement is found in the performance record of nine ships and in the actual ship clockings.

Evidently there are reasons for the waste of ship's time in the harbor other than the lack of machinery. The rehandling of freight on account of lack of transit floor space for incoming cargo, insufficiency of space to assemble outgoing cargo, and the untimely arrival of outgoing cargo stand prominent among these reasons, and cause relatively greater delay than could be made up by any crane installation.

The foregoing estimated saving of ten days for each turnaround is the basis for the approximate figures presented on page 380, which indicate that when the charter value per day of the individual vessel and the number of vessels that dock at a wharf in a year are taken into account the saving in ships' days justifies ample floor space and a considerable expenditure for machinery.

SHIP'S GEAR AND CRANES IN TEAM

The foregoing is on the assumption that cranes and ship's tackle, though working simultaneously, will work independently, each through the full cycle from wharf or lighter to hold. Cranes and ship's tackle are worked effectively in team at some of the foreign ports. In the loading operation the crane takes the draft from the wharf and deposits it on the deck alongside the hatch, and the ship's gear takes it from that point and deposits it in the hold. By this method advantage is taken of the ability of the crane to cover a considerable area on the wharf and place its load quickly without the need for "spotting" it over the hatch, while ship's gear is especially well adapted to transferring goods through the hatches to and from the hold. With many commodities the booms can be guyed in fixed positions and the goods dragged over the side of the hatch. Furthermore, it will also be possible for the crane, working in the less restricted space between the wharf and the ship's deck, to carry double drafts and so make only half as many cycles as the ship's hook.

The photograph on page 385 shows a compound crane at the port of Hamburg working in this way in team with ship's tackle. The crane has a straight-line unit and a revolving unit, each of which is working with one ship's boom.

CAPACITY AND TYPE OF CRANES

As to the capacity and type of cranes, the Commission believes that they should in general be capable of taking loads of three tons, and that the general character of the commodities they are to handle and the ships they are to serve should determine whether they be simple revolving or straight-line cranes, or a combination of the two like that referred to in the preceding paragraph. The operations of the revolving unit and the straight-line unit of a compound crane are so different that the two units can be carried and worked alternately on one substructure with little interference, serving a single hatch more effectively than two simple revolving cranes could. On the other hand two simple cranes can work in team with loads too heavy for either to handle separately.

This capacity of three tons per unit need not be adhered to rigidly. There are advantages in higher capacities for some of the cranes. The details of type, capacity and spacing should be governed by the character of the commodities to be handled. In fact, the very question of whether or not there should be any cranes on a wharf should be determined only after specific study of the case in question. As a general proposition, the Commission feels that cranes, where conditions are such that they can work effectively, will earn a good return on their cost. The character and quantity of the goods to be handled, however, and the type of vessels they would serve, may in numerous instances render them undesirable.

HANDLING GOODS ON THE PIER

Thus far it has been assumed that the only problem is getting the goods on and off the ship. Such is far from the case. A problem perhaps just as difficult, one that would certainly become very difficult were crane installations to speed up cargo transfer over the ship's side as proposed, and one in which the shortcomings of the Port of New York stand out more plainly to the student of the situation than in the matter of machinery at the water's edge, is that of handling the goods on the wharf, between terra firma and shipside. Here we encounter fundamental defects — a prevailing misconception of the proper function of a pier and pier shed, a dispensing of free storage in a manner defensible only because of a gross lack of supporting warehouse facilities, because of inadequate means for getting goods to and from the existing warehouses, and because of the demands of competition.

A wharf should be regarded solely as an assembling place for freight (and passengers) destined for a ship or ships that are to dock at the wharf, and a point of temporary deposit for the incoming freight and passengers on such ships. Because of the desirability already pointed out of having all or most of the outgoing goods at hand before loading begins — a desirable condition that becomes a necessity as the despatch increases — in order that the cargo may be drawn in the sequence required for proper loading, the wharf should be large enough for the contents of as many ships as it is intended to dock at one time less that part which will normally with high-speed operation be transferred to and from lighters direct. It should be large enough in addition so that a good percentage of the incoming freight from the same number of ships can be deposited in such a manner as to be easily accessible to the consignee, although a considerable percentage of freight is, and more of it should be, removed from the wharf while the ship is unloading. For general cargo this temporary storage space will naturally be covered as a protection against weather and theft, the proper use of which housing is suggested by its name, transit shed.

It may be desirable to make direct transfer of heavy pieces of cargo between ship and street truck, or ship and car, which will require open space alongside the ship. It is certainly desirable, if there are to be cranes or other machinery on the wharf, to give them open space in which to work. Present practice makes up and deposits drafts in the shed doorway. Crane operation should do this just outside the shed. Therefore the shed should not occupy the entire wharf, but should be set back a considerable distance from the dock, with many or continuous doors in the shed to make movement into and out of the shed easy.

Obviously the foregoing applies to wharves for both inbound and outbound cargo, in accord with the prevailing practice at the Port of New York. It is quite feasible, and desirable in certain classes of trade as pointed out elsewhere in this report, to use separate wharves for inbound and outbound cargo, towing the ship empty from one to the other. This will simplify the operations on each wharf, but as more ships will naturally dock at each the required capacities may not be much less.

INADEQUACY AND MISUSE OF NEW YORK PIERS

Almost all of New York's steamship wharves are piers jutting out into the stream, and few of them meet the above specifications. In the old days of small sailing vessels, the pier was merely a landing place, a sort of fixed gang plank. The capacity of the ship was small, and there was little difficulty in getting the goods to or from the ship's side as fast as they could be transferred over or through the side. The length of the pier was governed by the length of the ship and perhaps by the distance to deep water. The width was considered of little importance.

As steam replaced sails and ships grew in size there came to be some appreciation of the importance of ample width to store cargo. But the ships continued to grow, and after a considerable length of waterfront has been laid out with piers and slips it is difficult to change the widths of any of them. Nor has it apparently been realized in new layouts that the capacities of ships increase more rapidly than their length, and so while we now find piers 1,000 ft., 1,200 ft. and even longer instead of 600 or 800 ft., the widths have not increased to correspond with the large vessels they serve. More than one pier has been extended for larger ships with no increase in width.

Another angle of this is that lighterage piers are preferably narrow, and the lighterage piers in the harbor constitute a formidable total, which cannot be converted at will into satisfactory steamship piers.

A long-standing and deep-rooted abuse of piers at the Port of New York exists in the matter of free storage. The keen competition of the steamship companies, aided and abetted by the inadequacy and inconvenient location of the Port's warehouse facilities, and in many instances the uncertainty as to the exact date of arrival of the ship, has brought about the practice of extended free storage of goods on the pier itself. In railroad operation cars are usually available for outbound freight, and the railroad company clears its outbound freight house as the freight comes, or declares an embargo; while with respect to inbound freight clearly defined rules are laid down giving the consignee only a short but quite adequate time to remove his goods. Such rules are found in steamship operation, but are not generally enforced. Shipper and consignee regard it as their privilege to leave their goods on the pier to suit their own convenience, and the steamship companies, rather than lose the trade, give them wide latitude. The result is that the effective working space of the transit shed is usually greatly reduced.

Detrimental as this condition is to the efficiency of present equipment, it would be well-nigh fatal to attempt to speed up the turnaround by means of cranes. Imports not called for within a reasonable time should be removed to warehouses at the consignee's expense, while goods for export should not be accepted long in advance of the arrival of the ship. Warehouse facilities may be provided either on the hinterland or in the upper stories of the wharf structure itself; but that part of the pier used as a transit shed should not be used as a warehouse as well.

TRANSIT SHED ANALOGOUS TO RAILROAD PIER STATION

The transit shed thus becomes analogous to the railroad freight house, but the operation is more complex. The resemblance is closer to that of the local railroad pier station, since steamship wharves at the Port of New York are mainly piers, and must usually be in the future.

Inbound freight at both steamship and railroad piers consists chiefly of small packages (from 10 to 3,000 lb.) for a large number of consignees, and the goods must be spread over the floor so that the individual consignees can find and remove their goods with a minimum of delay. At both steamship and railroad piers, as they are at present operated, consignees' trucks must drive on the pier for the goods, the center of the pier being left open for its entire length, and the trucks must enter and depart at the same end, causing congestion unless the pier is wide. The special disadvantages of the average steamship pier as compared with the railroad pier are that it receives its load of inbound freight intermittently, from a relatively small number of large containers, and that custom does not compel the prompt removal of the goods.

Outbound freight can be received at one point at either the steamship or the railroad pier. At the railroad pier, however, as already pointed out, it passes almost immediately to the cars that are almost always waiting, while at the steamship pier it must arrive in advance and be so placed as to permit withdrawal as desired when the ship is ready to load. The outbound railroad freight house is little more than a gang plank. The outbound steamship pier must be at once a sorting floor and an equalizing reservoir.

REQUIREMENTS OF MACHINERY

Granted that the function of a wharf is to constitute a reservoir for receiving cargo from and feeding other cargo to ships, it may be asserted that there should be such equipment for moving the goods to and from the ship's side as will dovetail with the transfer operations at the ship, and that this equipment should combine speed, flexibility, low operating cost and adaptability to present-day commercial practice so far as this practice cannot be improved. The Commission believes that electric tractors and trailers meet the requirements of general freight most fully.

Hand trucks are at present almost the sole reliance for this work on the transoceanic piers at the Port of New York. (At certain other piers, notably those of Sound steamers which arrive and depart the same day and must be unloaded and reloaded with the greatest despatch, and a few railroad piers where despatch is also imperative, more elaborate equipment is in use.) Hand trucks meet two of the requirements — flexibility and adaptability to commercial practice — as well as low first cost, which, while not a controlling factor, is one to be considered; and probably there will always be use for the hand truck. It involves a high labor cost, however, and would fall far short of the despatch required to keep both wharf cranes and ship's gear busy.

No practicable system exists, it may be stated at the outset, for combining the operation of transfer over the ship's side and distribution on the pier — except in the handling of certain special commodities, such as coal and grain. For a general cargo the obstacles to such a combined operation are numerous, but the one which of itself would render such a system virtually useless is the fact previously pointed out that cargo comes to and from a large number of consignees and shippers and the entire transit shed is needed for assorting the cargo, so that there could be no single point of discharge or receipt for a conveyor system.

TRACTOR-TRAILERS VS. MONORAIL SYSTEMS

Load-carrying power trucks become more efficient than hand trucks as the distances become greater, but for the long hauls of the average steamship pier these also leave something to be desired. Two systems stand out as best meeting the controlling requirements of wharf-shed distribution — the tractor-trailer system and the overhead monorail-crane or adjustable-loop system. A good illustration of the former is found at Pier 14, Hudson River. The electric tractors haul trains of as many as eight or ten trailers, dropping them individually to be unloaded and picking up others at various points. The best known examples in this country of the monorail system in piers are perhaps those installed on the Baltimore & Ohio pier at Locust Point, Baltimore, and in the municipal quay shed at Beaumont, Texas.

The monorail system consists essentially of a single-rail overhead track on which travel suspended carriages. These correspond to tractors, trailers and load-carrying trucks. The tractor carriage has suspended from it an operator's cab. The trailer has either one or two crabs. The combination carriage has both cab and crab. Thus the system may be operated either with single load-carrying units under their own power, or in trains hauled by one power carriage.

The tracks may be laid out in various ways for the overhead monorail system, of which the adjustable loop system is but one form, itself capable of much variation. What is probably its most effective development consists of a fixed rail on each side of a long open space in the building, defined by the walls of the building or rows of interior columns, and two movable girders, on the upper side of each of which is a rail which by means of curves at the ends joins with the fixed rails, whatever the position of the girders. The girders can travel the length of the open space. Additional loops may be formed by additional pairs of girders.

If a ship is unloading, the drafts as they come from the ship are transferred to the hooks of a series of carriages coupled to form a train. One operator moves the train to the point of deposit, being in control not only of the train but also of either bridge so long as his train is on it. At the point of deposit each draft is unloaded as desired, and when all drafts are deposited the train moves forward around the loop to the ship's side. The process is reversed for loading, but the direction of travel is always the same.

Speed — If the speed or despatch of cargo transferred is increased by the addition of wharf cranes, as we have seen that it can be done, it is evident that there must be equal despatch in the distribution on the pier. It is believed that either the tractor-trailer system or the adjustable loop system would meet the demands in this respect; that is, that they would furnish freight to the ship's side or distribute it therefrom as fast as is required by the improved method of transfer.

Flexibility — In flexibility the advantage rests decidedly with the tractor-trailer system. Independent tractor-trailer trains can work to and from any and all hatches at one time, passing each other at will wherever there is an aisle wide enough. Because the monorail system has but one track the trains cannot pass, but will continually block each other if the attempt is made to work trains to or from several hatches at once. The practical effect is that with one loop it is feasible to work only one or possibly two hatches at a time, while the operation of additional loops restricts the area covered by each loop. Again, while tractor-trailers can cover the full width as well as length of the shed, the monorail system cannot, if there are interior columns, as is usually the case, reach beyond them.

Operating Costs — The direct operating costs of the two systems should not differ greatly. A train of trailers should be able to carry as much freight as a train of carriages. Drafts can be deposited at ship's side directly on trailers and carried unbroken in them to the point of deposit, and drafts with outbound cargo can be made up on trailers at the stock pile. Transfer of the draft is therefore possible between the machinery at the ship and either the trailers or the monorail carriages.

As to labor, one operator can handle either a train of trailers or a train of carriages. The cost of transference between cargo tackle and either the trailers or the carriages should be about the same, and the same is true at the other end of the trip.

Adaptability to Commercial Practice — There is a pronounced difference in the two systems in the matter of adaptability to commercial practice. The ordinary cargo consists of every manner of commodity, in every manner of size, shape and strength of package. It comes from hundreds of shippers or goes to hundreds of consignees. Incoming cargo can best be classified for removal by the consignee on a wide pier, where it can be spread out, while outbound cargo also favors the wide, low distribution where it is easily accessible in the selective process of loading the ship.

Tractors and Trailers in Service at Railroad Pier Stations in Manhattan — Top View Shows Successful Consolidation of Outbound

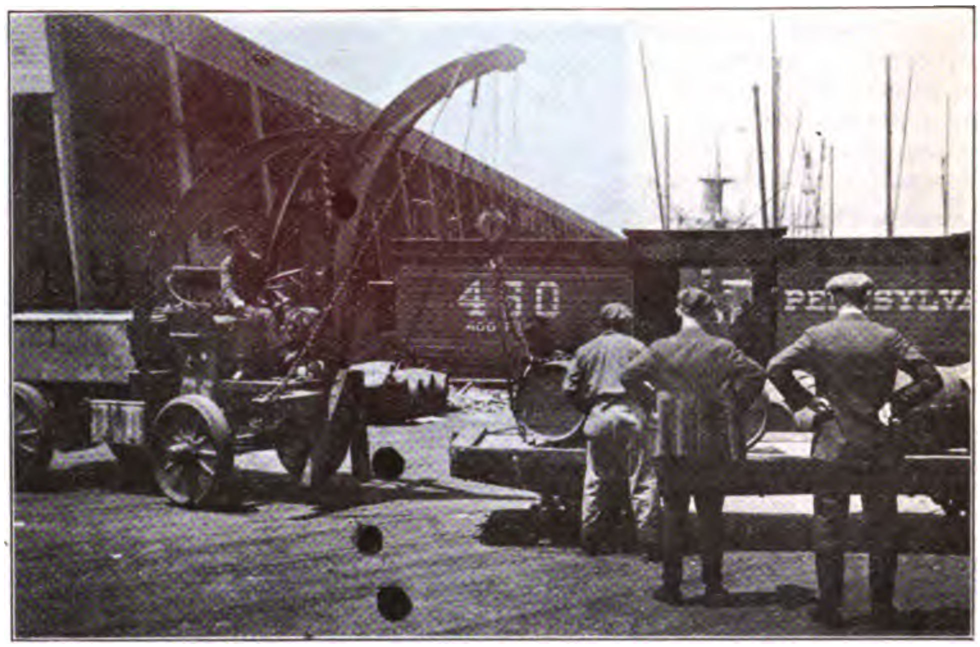
Freight Where There Is Ample Room — Bottom View Shows Consolidation Where Less Room Is Available

Tractors and trailers work best on such a wide area. In the case of the monorail system, however, the cost of the girders increases much more rapidly than the span, and to keep this to a reasonable figure and avoid interior columns beyond which the monorail carriages cannot reach, the shed must be relatively narrow. The loss of width, if the transit shed is to have the required temporary storage area, must be made up by high tiering. Because of the variety in shape, sizes and strength of packages it is often unsafe to stack them beyond a certain limit. Furthermore, the goods must be accessible for assorting by consignees and grades if inbound and by consignees and ports if outbound, and they are not accessible when tiered high. Consequently high tiering in a transit shed is objectionable from the standpoints of both safety and convenience for assorting. The working capacity of a transit shed served by the adjustable loop system is thus greatly restricted, the advantage in this important respect being decidedly in favor of the tractor-trailer system. Again, the very saving through the shortened girders of the monorail system is partly lost through the increased cost of the floor systems to take greater loads.

There are other phases of this question of adaptability. Goods resting on a truck floor are more definitely controlled than those hanging in a sling; there is less likelihood of a collapse of the draft and consequent damage to the goods. Care must be taken in both the design and operation of the monorail system so that the suspended swinging loads will not collide with the columns or other parts of the shed structure, and care must be exerted in the tiering that the goods do not reach so high as to be struck by the moving carriages or their loads. Such collisions as do take place with the tractor-trailer system are nearer the floor and are likely to cause less damage. The damage items in such monorail systems as have been used in this country for general freight are a serious argument against them.

The Commission recognizes the great utility of the monorail system as at present developed for certain purposes, and its wide possibilities for future development. The foregoing comparison is based upon the monorail and tractor-trailer systems as at present available for pier use. The former is good but the latter is better. Still other devices, such as shop cranes, moving platforms and conveyors of various types, are in use on certain piers, and the Commission recognizes the likelihood that at the particular points where they have been installed they are well adapted to the work. For general cargo it is questionable whether any of them are as well adapted as either the monorail or the tractor-trailer system, both of which reach large areas with detachable cars or carriages.

To sum up, the Commission believes that electric tractors and trailers, supplemented by hand trucks for short hauls in limited space, and by electric load-carrying trucks in exceptional cases, afford the best agencies for the moving of general cargo within the steamship pier, and urges them as an essential part of the equipment of such piers, particularly those that are to be fitted with wharf cranes. The exact number, sizes, capacities and other details of the tractors and trailers can be left to each particular case as it arises.



Self-Propelled Storage Battery Electric Crane in Service at Bush Terminal

CUSTOMS WEIGHING

There is one serious obstacle in the way of efficient handling of cargo within the pier. That obstacle is customs weighing as at present handled by the Federal authorities. This subject is discussed at some length in another section of this chapter (page 401), and changes are suggested which would simplify operations on the pier without, in the estimation of the Commission, detracting from the reliability of the weighings. Suffice it to say at this point that virtually all imports must be weighed before being removed from the pier or placed in storage, and must be weighed in a stationary position. This requirement entirely prevents the use of certain mechanical contrivances and impedes that of many others. If present practices cannot be modified, however, the tractor-trailer system is better adapted to the requirements than anything else except hand trucks — much better adapted than the monorail system.

Coastal, Sound and River Vessels

Coastal, Sound and river vessels represent individually a smaller investment than transoceanic vessels, although the ships plying between New York and the Gulf ports and certain of the Sound steamers compare favorably with many of the transoceanic vessels. The group includes ocean-going ships that go to the Gulf ports and others that turn back at Savannah or other Atlantic ports; the so-called Sound steamers, plying in Long Island Sound between New York and New Haven, Fall River, Providence, Boston and other ports; the Hudson River steamers, large and small, and various other local steamers plying between New York and Long Island or north Jersey points.

The Gulf passenger liners have from four to seven days in port. Virtually all of the vessels on the shorter runs, whether to Fall River or Albany, operate on a schedule calling for their departure within twenty-four hours of their arrival. Most of them arrive in the early morning and depart the same evening. Consequently, while the value of the individual transportation unit is less than in ships of the first group, a quick turnaround is even more vital, because failure to accomplish it results not only in loss of earning power but also in nullification of the operating schedule.

The differences in types of vessels in this group are perhaps greater than in the case of transoceanic ships. The small river steamer has a single freight deck, and carries no freight below the deck. The large Gulf liners, on the other hand, may have side ports at two or three deck levels, and what amount to interior hatches affording access to the cargo space, which may be large, below the lowest of these decks. In general, there are two distinctive types of vessels in this major group: Ships, high-sided and of deep draft, built to withstand heavy seas, with the several decks mostly enclosed within the hull; and steamboats, low-sided, usually broader and shallower, built for sheltered waters, with the entire upper part carried as a superstructure on a main deck not far above water level. In the ship class are all of the coastwise liners and a few of the Sound steamers. In the steamboat class are most of the Sound steamers, all of the Hudson River boats, and the short-haul vessels, largely devoted to passenger business, plying between tidal points within or just outside of the Port District.

CARGO TRANSFER

Handling cargo through side ports is quite a different process from handling it over the side of the vessel, through hatches. In the case of the multiple-deck vessel with hatches as well as side ports there may be a considerable vertical movement, requiring some sort of tackle; but otherwise the movement is substantially horizontal, and simple trucks, hand or power, can accomplish it. On the other hand, despatch is even more imperative than in the case of transoceanic ships, because of the necessity for maintaining a schedule. There is in fact not much space or opportunity for other machinery than power trucks and trailers, and even these must be supplemented by a large amount of hand labor to get the vessel unloaded and reloaded on time.

An improvement found at a few piers is the adjustable ramp or gangway equipped with an inclined conveyor, which is simply an endless motor-driven chain carrying at frequent intervals lugs that engage the axles of the hand trucks and "boost" them up the incline. A longshoreman pushes the truck to the foot of the ramp, steers it up the gangway while the conveyor pulls it, and then proceeds on his way.

A number of large ships in the Gulf trade have hatches as well as ports, and tackle for transferring goods through them.

TRACTOR-TRAILERS IN USE ON PIERS

Because of the necessity for a quick turnaround, and the closer control of the entire operation of unloading and reloading, the tractor-trailer system has been developed to a considerable extent on some of the piers serving vessels of the second group. The first extensive installation of this character was on Pier 14, Hudson River, where the Fall River Line put in load-carrying trucks for transporting freight between the steamer and points on the pier. An extension of this service was effected in a system of receiving all outbound freight at the bulkhead shed and carrying it down the pier to the steamer by the trucks. The next step was the use of trailers drawn by tractors for distribution on piers as well as for cargo transference. There is also direct transfer on the open Marginal Way between street trucks and pier trailers.

Recently several lines, notably one of those on the Hudson River, have been using tractors and trailers both for pier distribution and for cargo transference, with the great difference that the trailers are left on board the vessel and taken off only at destination, being there drawn off by the same means, unloaded, reloaded and drawn back on board for shipment back to this port. This is an advanced use of the tractor and trailer system on pier work, but it is not applicable to all cases. Most kinds of freight cannot be tiered successfully on top of a succession of loaded trailers, no matter how closely they may be placed. The limit of tiering being therefore the top of the trailer load and there being a fairly well defined limit for the load on the trailer, there will be a considerable amount of unused space on board the ship unless the distance between decks is unusually small. On vessels like those of the Fall River Line, where the load factor of the boat is high, this loss of space cannot be permitted. In some cases it is anticipated that an additional deck may be inserted midway between existing decks in order to minimize the loss of space above the trailer load.

TRACTOR-TRAILERS SUPERIOR TO LOAD-CARRYING TRUCKS

When load-carrying trucks were used for cargo transference on Pier 14 the cost of handling was less than by hand trucks, but the despatch was slower. In order to turn the ship around in time to meet schedule requirements and still take advantage of the economy of the electric trucks, the latter were used at the same time as hand trucks, being interspersed in the line of longshoremen handling the hand trucks.

In cases where floor space on pier and on ship permits the use of trailers, and sailings are frequent, the tractor-trailer system has great advantages, especially when all outbound freight is received at the bulkhead; but with such a multiplicity of consignees as all of these vessels have to carry freight for it seems hardly feasible to deliver all inbound freight as well at the bulkhead, with the prevailing size and design of piers. The experiment does not appear to have been made. In general the use of load-carrying trucks has been moderately successful for loading Sound steamers, while the tractor-trailer system has been much more successful for both Sound and river steamers.

Hand trucks perform the entire service on both pier and boat for the small steamboat lines.

RECOMMENDATIONS

The Commission sees no need for any sweeping change in the equipment of operating methods at piers serving vessels of the second major group. It urges more universal use of tractors and trailers at the most important of the side-port lines, provided the vessels are so designed as to permit the tractors and trailers to run upon them. The practice of leaving the trailers on the vessels can well be extended, and the possibility of doing this should be taken into account in the design of future steamers of this class. Conveyors can often be used effectively in handling special commodities in quantity in uniform packages.

For steamers of the less important lines there is no need for any equipment other than hand trucks, while the hand truck, assisted to a greater extent by adjustable ramps with power conveyors, will continue to be the means of transferring cargo of vessels not adapted to taking tractors and trailers aboard, whether or not tractors and trailers are used on the pier itself.

Barges — Harbor and Canal Craft

The third group of containers — harbor and canal craft and barges in general — include such a variety of boats serving such a variety of purposes that it is difficult either to list the machinery now existing in the harbor for transferring their cargo or to specify what is needed. The boats of this class can best be considered in groups.

LIGHTERS

Lighters, as we saw in the definitions of boats of this class, range all the way from simple barges or scows to steam lighters with powerful derricks. According to the equipment on the lighter, to the equipment on the pier or ship at which the lighter loads or unloads, and to the nature of her cargo, her cargo is transferred by her own equipment, by ship's tackle, by pier cranes or by hand trucks. Many of the railroad and other piers where much general lighter freight is handled have ramps set in the side, some of them adjustable and a few equipped with inclined elevators. Locomotive cranes or cranes of the overhead type are used for the heavier grade, such as steel products and boxed machinery, and occasionally for light package freight between car and lighter, the overhead type being more suitable than the locomotive crane for that purpose.

Tractors and trailers or load-carrying trucks are used to some extent, notably on the Pennsylvania's covered pier at Greenville and on one of the Lackawanna's piers. Gravity roller conveyors have been used in many places about the harbor, but not to any great extent. A number of power conveyors have been used in connection with barges, but never with much success until a very light portable type was developed which, in some conditions of tide and weather precluding the use of load-carrying trucks and trailers for unloading lighters, has done good service.

The tackle of steam derrick lighters is usually employed for handling their cargoes unless a wharf crane is used or unless the lighter is alongside a covered pier, and frequently excellent despatch can be made by skillful operation with such equipment.

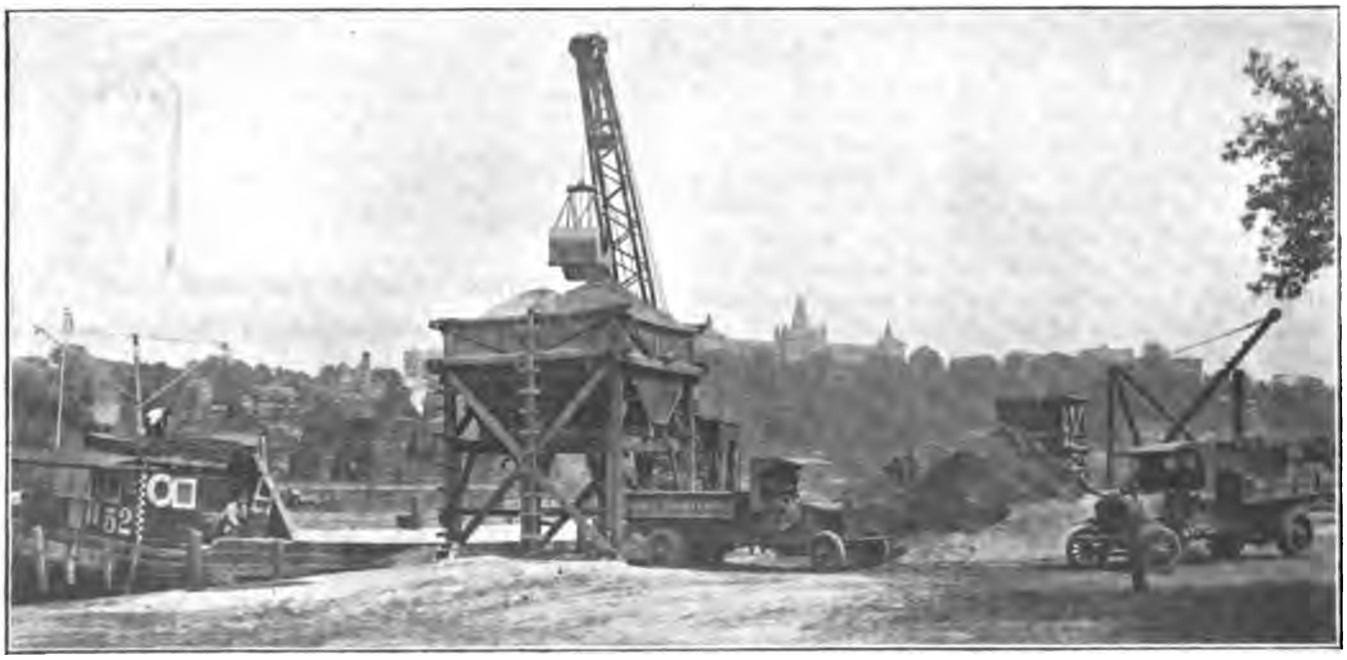
The harbor is not supplied to any extent with mechanical appliances for loading and discharging lighters, but it is difficult to determine the deficiency without exact standards of comparison and a higher development of suitable appliances. In certain fields both power conveyors and the tractor-trailer system may be made suitable. It can hardly be expected that lighters will all carry equipment for handling every kind of freight they transport, especially since their tackle is not used at all when they are working alongside ships. The need for better and more extensive means for loading and discharging lighters is most apparent at steamship piers where there is a transference of freight at berths not occupied by ships. Wharf cranes such as have been recommended would very well fill this need.

Probably the reorganization of the Port proposed by the Commission in its general plan will lessen the use of lighters. It should be realized, however, that the capacity of the Port to use them is an element of strength and not of weakness. As conditions exist at present they are most vital to the movement of goods at the harbor. The wide range of type, capacity and power equipment seems to conform to the demands of the service, and the Commission has no change to propose with respect to the vessels themselves. The high-capacity derrick boats are an excellent medium for transferring heavy parts to and from piers, ships or cars, and their usefulness will doubtless always continue. The cranes at the railroad piers are discussed under the fourth class of containers — railroad cars.

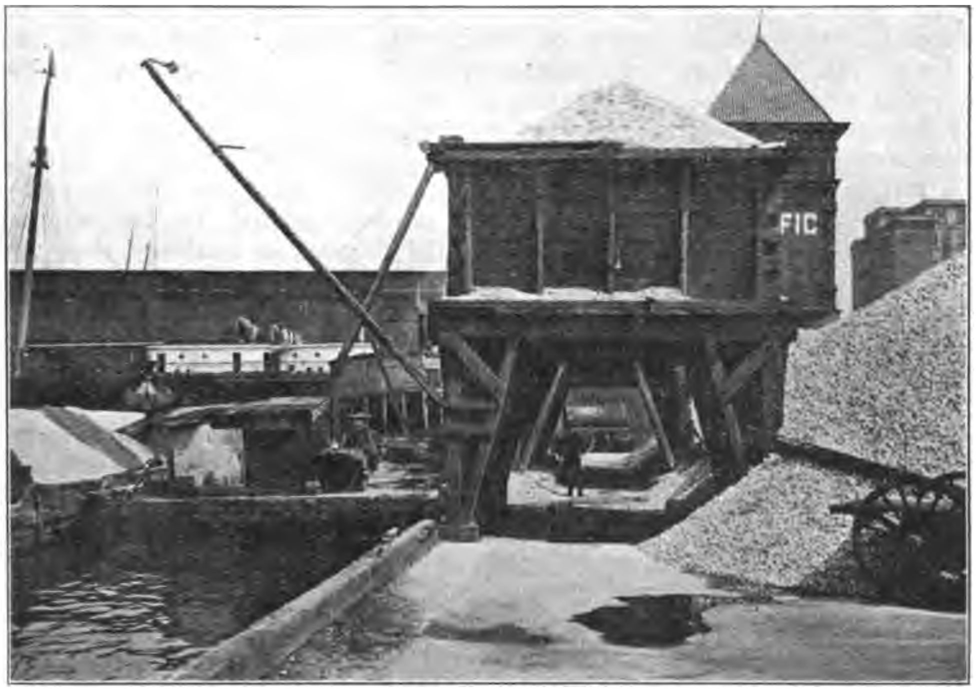
Canal Vessels

When certain installations under way or planned are completed, six terminals of the New York State Barge Canal will be effectively equipped. Inasmuch as canal boats are entirely without derricks or other transferring machinery, it has been the policy of the State of New York to provide its terminals with fairly complete apparatus to transfer the cargoes. The terminals resemble on a small scale some of the layouts suggested by the Commission for transoceanic vessels — transit sheds set back some distance from the dock and the intervening space served by traveling cranes of both the revolving and the straight-line type.

These terminals are discussed at some length in



Locomotive Crane and Gravity Discharge Hopper Transferring Gravel from Lighter to Dray



Derrick Lighter Transferring Sand from Lighter to Gravity Discharge Hopper

Chapter 25 of this report. Aside from them the facilities for serving canal barges are almost nil. Package freight lines using either private or public wharves rely on hand trucks or the most meager equipment. The New York and Delaware River Steamship Corporation, which has until recently been using part of Pier 22, East River, in the operation of a package line through the Delaware and Raritan Canal to Philadelphia, has no equipment other than hand trucks for handling freight either on its vessels or on piers. The General Electric Company's lighterage department, operating to Schenectady, uses part of Pier 5, East River, and has a wooden derrick crane with an electric winch. Other Erie Canal lines, most of which also use Pier 5, utilize an auto crane or one of the wooden masts along the side of the pier.

Canal barges delivering or picking up freight at private wharves, such as those of industries, are on the same footing as harbor lighters and use the same equipment, provided the construction of the barge will permit. Most canal freight at the pier is loaded as discharged at private terminals, chiefly those of industries. Lumber from Canada and Buffalo arriving at the Port is unloaded by hand. Iron and steel brought from Buffalo is largely for export and is transferred direct into ships by ship's tackle. The Port's efficiency with respect to Barge Canal grain is covered by Chapter 29.

With the recent completion of the Barge Canal and the probable creation of a more efficient canal system across New Jersey, the importance of canal transportation to the Port of New York should be greatly increased. It is unlikely that canal barges will ever carry much equipment for transferring their own loads. A special field for the canal is the transportation of low-grade bulk freight, which will naturally be carried in hold barges or boxes. The loading and unloading of such vessels can best be accomplished by shore equipment, and there is a crying need for such equipment and for cranes to handle package freight, as well as for the wharves themselves to handle the canal traffic.

HOLD BARGES

Hold barges of the type known locally as boxes are used for carrying coal, grain, sand, gravel and the like, not only from the canals but from Hudson River and New Jersey points. They are also used by the local municipalities for transporting garbage and rubbish. Many of New York City's bulkheads are rented to companies handling building material or coal, the lessees furnishing all needed equipment. Considering that this is never of a permanent nature, the character and extent of it is fairly high. For sand and gravel the equipment usually consists of a derrick and grab-bucket operated by a power winch and a hopper for stabilizing the outflow. Catamarans (derricks mounted on wheeled platforms) are used on many bulkheads and open piers, especially along the Manhattan shore of the East River, while occasionally the hoisting apparatus is all mounted on a scow. Frequently no hopper is used but the materials are unloaded directly on the bulkhead or pier. Plants well equipped for these purposes exist in many parts of the harbor.

The whole question of better machinery for serving boxes is tied up with the larger question of a more rational selection of terminal sites for handling the various commodities.

SPECIAL EQUIPMENT

Apart from the heavy derrick boats, which come under the class of lighters, we have a variety of floating craft for special service, such as floating grain elevators and portable coal elevators. These vessels again are useful inversely as more direct means of transferring grain and coal from car to ship are provided. Whatever in the way of joint elevators and bunkering plants are built, however, the usefulness of this special floating equipment will never wholly disappear.

Special equipment of an elaborate nature for handling coal and ashes is found at the various power houses of the large transit and lighting companies, most of which are on the waterfront; and similar facilities for receiving coal are found at a number of the large coal yards. These facilities usually take the form of grab buckets operating from high conveyor arms overhanging the water.

Railroad Cars

Coming now to the fourth major group of freight containers, railroad cars, we find two principal means of transference — hand trucks for general package freight and cranes of various types for heavy pieces. For operations in and through freight cars and short distances along platforms hand trucks will never become obsolete. Tractors and trailers are being used successfully at a few railroad pier stations, and their use should be extended, whether at the pier stations or at the inland stations which will replace most of the pier stations when the Commission's general plan is carried out.

Cranes of various kinds are found at the yards and inland stations of the railroads for transference of heavy pieces between cars and trucks, platforms or the ground. The demands for equipment of this sort at the Port of New York are no different from those throughout the country, demands which the carriers fully understand how to meet.

Miscellaneous package freight is handled mainly at covered lighterage piers. The tracks usually run inside the pier shed, and the cars are unloaded by hand trucks, which also run aboard the lighters. There is some but not much direct transfer between car and ship at the piers.

The problem peculiar to the Port of New York in the loading and unloading of cars is the transfer of heavy pieces for export and import. This is done mainly by cranes at open piers, and as in the case of the smaller packages, very little of it is to and from ships.

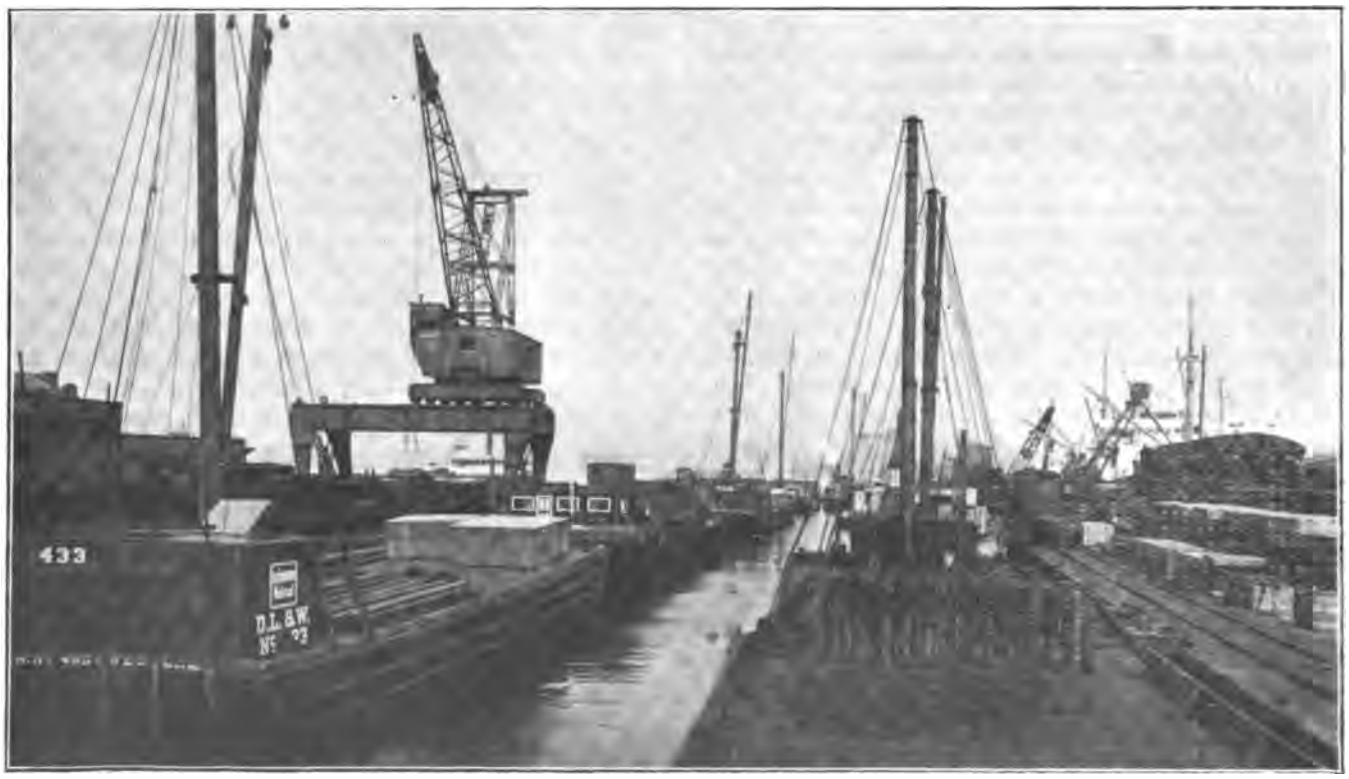
Two Types of Cranes

In general there are two classes of cranes in use in New York Harbor on railroad piers — locomotive cranes and elevated machines of some sort. The former are of the ordinary eight-wheel type; they are operated by steam, and travel on the same track as the cars. In the latter class are revolving portal cranes and conveyor or straight-line cranes. They run on their own rails, spanning from one to three tracks, and are operated by electricity.

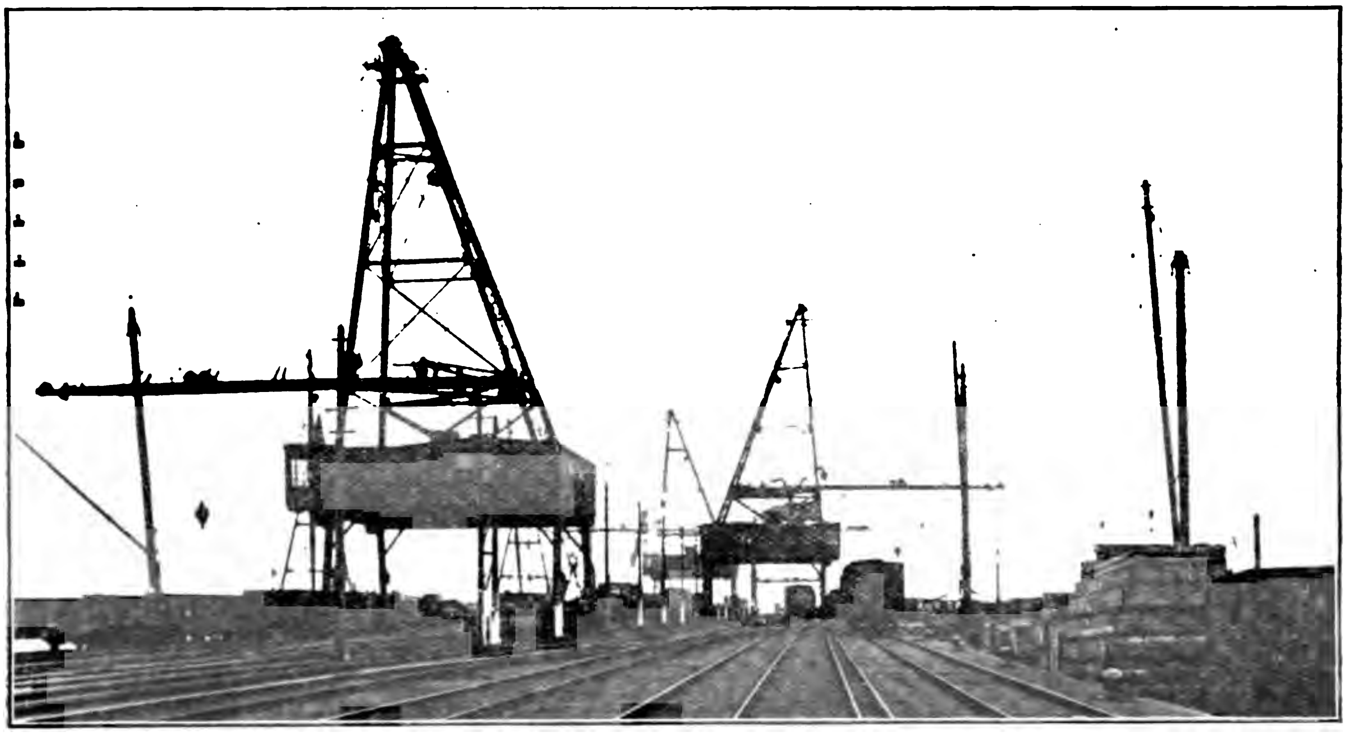
Locomotive Cranes — Steam locomotive cranes in this country have progressed in design and manufacture to a very satisfactory point, and are as nearly a standard product as can be desired. For indiscriminate use throughout the country in localities where electricity is either lacking or inapplicable, no fault can be found with steam as a choice of power; but the advantages of electricity for the operation of cranes in such highly developed localities as piers are beyond question. The control and operation of the latest installations of overhead cranes, in which electricity is the motive power, are highly selective and delicate.

The locomotive crane necessarily runs either on a track alongside the car it is working or else takes its position next to the car on the same track. In the first case one track on each side of the pier must be kept clear for the crane, and a large amount of expensive pier space is consumed. In the second case frequent switching is necessary to place fresh cars next to the cranes, and additional time is lost in getting the cranes out for coal and water. Ordinarily a locomotive crane on the outside track cannot work a car on the third track if the second track is occupied. The heel of the jib is so low as frequently to interfere with freight either on the car or on the lighter, and operation with a ship of any size is impossible for the same reason.

The lower cost of this kind of crane is one of its strong points, the other being the possibility of its use on any existing track without pier modification. The majority of the New Jersey railroads have piers served by locomotive cranes.



Open Lighterage Piers in New Jersey Waterfront Yard — Revolving and Traversing Crane Mounted on Full Portal, and Locomotive Cranes Transferring Freight Between Car and Lighters



Open Lighterage Pier in New Jersey — Full-Portal Straight-Line Gantry Cranes at Work, Car to Lighter

Overhead Cranes — Most of the ordinary types of overhead cranes — the straight-line and the revolving — have been used extensively on open railroad piers at the Port. The straight-line type was the one first used, and for some years it monopolized the field. Usually it has arms that fold back when not in use, so as to offer unlimited clearance over the top. The latest crane installations, however, are of the revolving jib type, usually with traveling, slewing, luffing and hoisting motions.

Typical installations of the conveyor type are found at the Pennsylvania's open pier at Greenville. One of the cranes on this pier is of 20 tons capacity; the others are of 10 tons capacity. The West Shore and the Central of New Jersey also have cranes of this type.

The latest and one of the most efficient installations of the revolving type at the Port are those of the Erie on Pier II, Weehawken. This is an open pier with five tracks. On each side are two cranes, each spanning two tracks. Three of these have a capacity of 10 tons with an auxiliary hoist of 5 tons capacity. The fourth has a 20-ton capacity with a 5-ton auxiliary hoist.

The Lackawanna has a modern crane of high capacity and efficiency on Pier 1, and one of smaller capacity and less efficiency on Pier 3. The former spans three tracks and has a traversing unit capable of handling 30 tons. It is in almost constant use. The latter, with a capacity of 20 tons, spans only one track.

There are several other cranes of the revolving types on various railroad piers. Almost all of the cranes of all types are in fairly continuous use.

Straight-Line vs. Revolving — Both straight-line and revolving cranes have their uses. The operating costs per ton and the despatch of the best examples of each probably do not materially differ. The Commission believes the revolving type is preferable at uncovered lighterage piers because it can reach additional trackage and so reduce shifting. Either type is more efficient than the locomotive crane for frequent and intensive service on an open pier.

EXISTING CRANES NOT COMPARABLE WITH THOSE OF FOREIGN PORTS

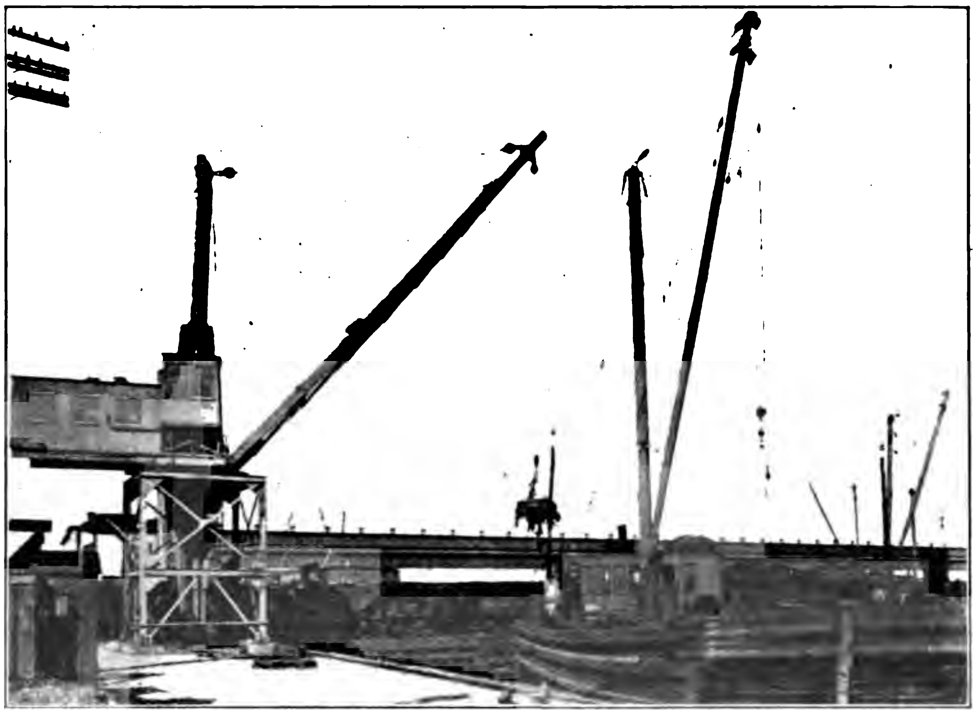
These cranes, both the locomotive cranes and the overhead cranes, are used almost exclusively, as previously stated, for the transfer of freight between cars and lighters. Few of the piers carrying them have deep enough water for transoceanic ships, and there has been very little direct loading or unloading of ships at any of them.

The cranes are in no way comparable to those at European and other foreign ports, or to those recommended for general cargo at steamship piers at this port. The piers carrying them are mainly at the extremities of railroad yards and not accessible to trucks. None of the piers are shedded to provide temporary storage, and the majority of them are well covered with tracks, further eliminating the possibility of storage. Finally, the cranes are of altogether too high capacity for general cargo transfer, causing a considerable movement of dead load with each draft, with resultant high cost and low speed. The cranes are designed for the one purpose of transferring heavy freight between cars and lighters.

Special cargo of heavy pieces can be transferred between ship and car direct at these open piers, but even here the advantage is not wholly with the pier crane. Observations were made of the comparative performances of pier cranes and floating cranes in this sort of work. No case was found of exactly the same commodities handled by the two different methods, but rough deductions can be made from three sets of observations — one the transfer by a 10-ton pier crane of rails from an open car to a ship, another the transfer by a 20-ton crane of locomotive parts from an open car to a ship, and the third the transfer by a floating crane of high capacity of assembled locomotives from a lighter to a ship.

There was little difference in the labor costs, the floating crane having a slight advantage. In the matter of despatch, however, the floating crane made decidedly the best showing. Taking a small number of drafts of about 60 tons each it averaged 46 tons per hour, while the 20-ton pier crane, taking an average draft of 5½ tons, averaged only 18 tons per hour, and the 10-ton pier crane, taking an average draft of 2,200 lb., averaged only 13 tons per hour.

The cost figures are not illuminating, for the reason that in the case of the floating crane there are the other items of transferring the locomotives to the lighter and towing the crane and lighter to the ship, and the heavier overhead of the lighter and floating-crane equipment. On the other hand, none of the existing pier cranes has sufficient capacity to handle assembled locomotives, and it would hardly be desirable to install such cranes at fixed piers when a few floating cranes can meet the needs of the harbor. The field of the open-pier railroad crane, therefore, is between that of the recommended wharf crane for general cargo and the high-capacity floating crane.



Fixed Revolving Crane Using Magnet in Transferring Between Car and Lighter

With the extensive reorganization of the New Jersey railroad waterfront outlined in Chapter 22 and the creation of steamship terminals at the termini of the proposed exterior belt line, the need for transshipment facilities at the present railroad waterfront terminals will be entirely changed.

Special Commodities

Elaborate facilities are found at the Port of New York as at many other ports for unloading cars containing certain commodities, notably grain, coal and ore. The Lehigh Valley has a Hulett ore unloader at Constable Hook. The New York Central, West Shore, Erie and Lehigh Valley railroads all have grain elevators which unload, treat and store the grain from cars, and the Lackawanna has a grain trestle for direct transfer of grain from cars to lighters. Each of the New Jersey railroads, with the exception of the West Shore and the New York, Ontario & Western, have one or two car dumpers which take a car of coal and empty it bodily into a barge or other vessel. Until recently all of the railroads except the Lackawanna depended for this service upon elevated coal trestles, and most of the roads still have such trestles in operation.

Chapters 28 and 29 of the report go more fully into the handling of fuel and grain. The grain-handling facilities are quite inadequate. The bunker and export coal-handling facilities are in general also inferior to those of several other Atlantic ports, but the problem at the Port of New York is different for the reason that the bulk of the coal received here is for local consumption or for the fueling of vessels, little being exported. In the chapters referred to the Commission makes recommendations intended to remedy the defects of the Port with respect to those commodities.

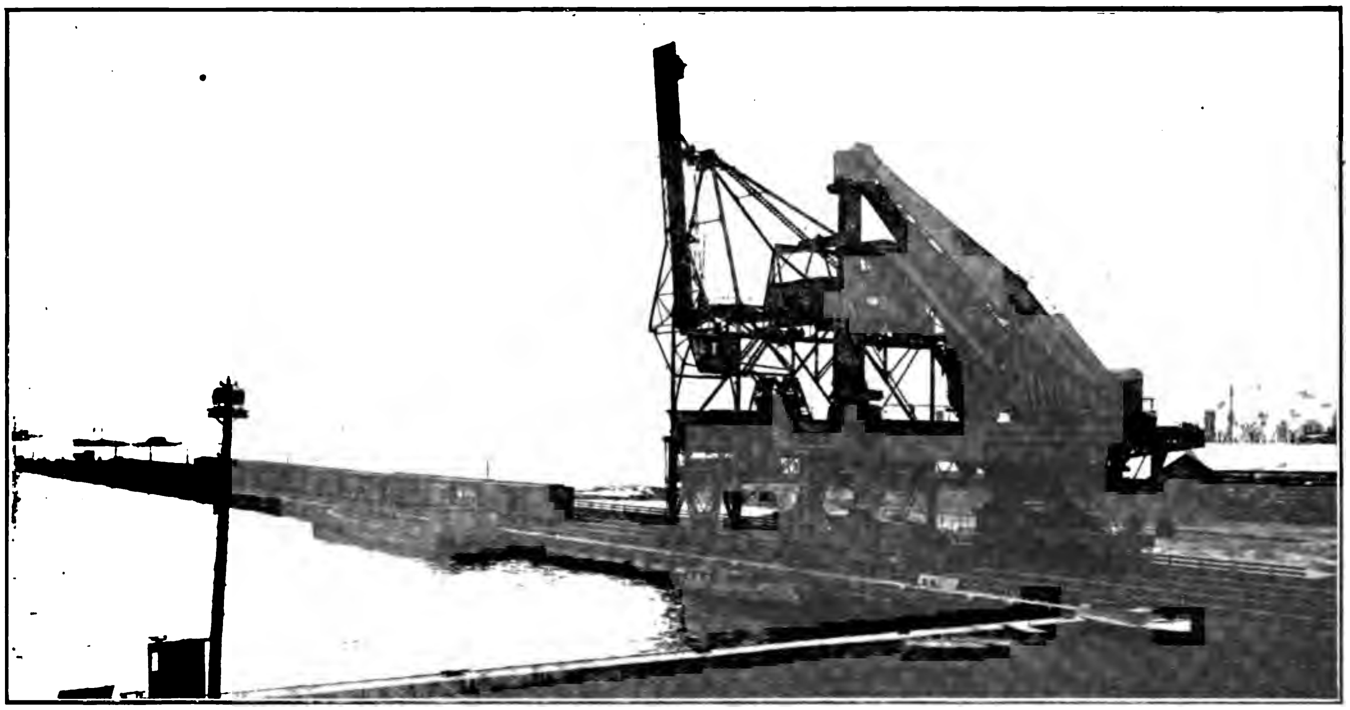
There are other commodities in the handling of which special machinery can be profitably employed. In fact, large quantities of single commodities in uniform packages offer the best opportunity for economical handling by machinery.

Warehousing

An important adjunct of shipping, one that deserves far more attention than it is usually given, is warehousing, to which a separate chapter of this report is devoted (Chapter 18). Freight comes to the Port of New York by train when there is no ship in port to receive it, and sometimes it must be stored for weeks. Cargo from incoming ships is discharged on piers before its owner is ready to receive it, and it also must be stored. The goods frequently change hands while at the Port, and sales are made at the warehouses, where the goods are held for one reason or another awaiting the desire of the owner to move them forward.

Early pier design did not recognize this difference between extended storage, to be paid for, and a legitimate maximum free storage required in the transfer of the cargo between ship and other transportation units or local shipper or consignee. Manhattan piers, therefore, the oldest in the Port, have practically no warehouse facilities within easy reach, and this fact is largely responsible for the unreasonable extension of the free-storage privilege, as well as for the congestion of drays on the piers. The alternative here is storage at private warehouses scattered throughout the city — warehouses that have no standard procedure in the way of rates or rules, and that are in the main poorly equipped. The construction of warehouses along the Marginal Way, as provided in the plan set forth in Chapter 21, will materially change the situation.

Some of the piers have warehouse facilities near at hand, either in upper stories of the pier or in separate structures just inshore from the piers. The new piers recommended by the Commission at various points in the harbor include warehouse facilities of this character.



Open Lighterage Pier and Unloading Machine in New Jersey Used for Transferring Ore Between Car and Boat

FREIGHT-HANDLING MACHINERY IN WAREHOUSES

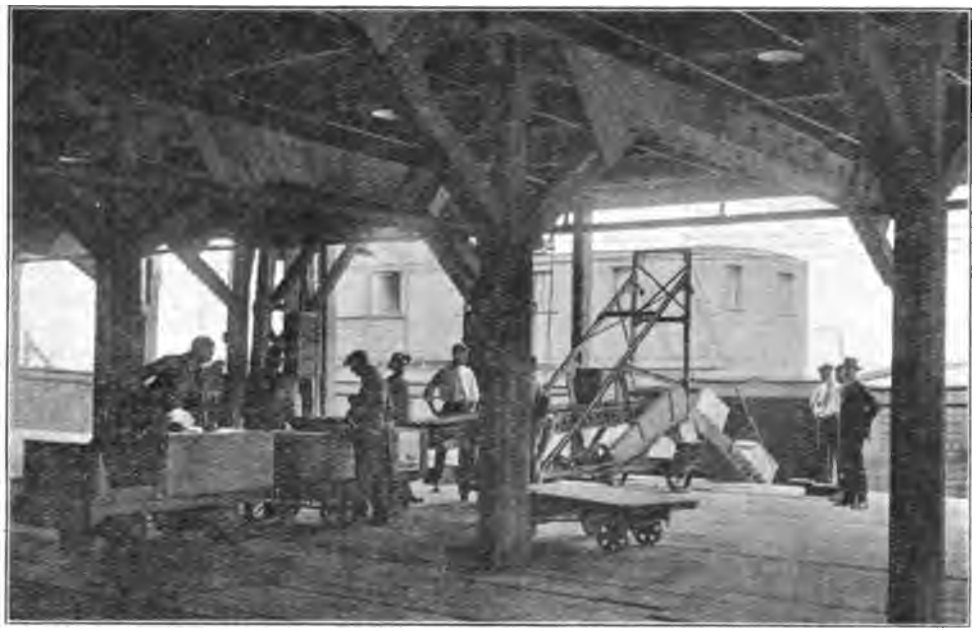
The majority of these widely scattered private warehouses have little in the way of freight-handling machinery, although many of them are excellently designed and constructed as containers of goods. In the well ordered, multiple-story warehouse there are some five requisites to the business of storing goods: (1) Means of getting goods into and out of the warehouse to or from wharves, street trucks, railroad cars or lighters; (2) means of conveying the goods about the floors; (3) means of getting them from one floor to another; (4) means of piling them to conserve space, and of removing them from piers; and (5) facilities for weighing them. The equipment for these purposes at the majority of the existing warehouses consists of hand trucks and small elevators to move the goods within the building, whip hoists to raise and lower them between floors outside of the building, and scales of some sort. Large elevators for carrying a number of loaded trailers are found at the new Brooklyn army supply base and a few at the Bush Terminal warehouses, tractors and trailers are used at a number of warehouses, and tiering machines of one kind or another are used at a few.

Horizontal Movement — The problem of moving goods on the warehouse floors is about the same as that of moving them in the transit shed, and probably the best media in the large warehouse are tractors and trailers. Some of the disadvantages of the adjustable-loop monorail system for wharf-shed purposes are not so evident in warehouse operation. On the other hand, the need for utilizing the full cubical capacity is more definite in the case of the warehouse than in that of the wharf shed, and the monorail system wastes much more space overhead than the tractor-trailer system wastes in wider aisles, except possibly in the case of commodities that can be tiered high.

Generally the warehouse should be contiguous to the wharf shed or nearly enough so that tractors and trailers can operate in both and from one to the other. In some instances, however, the two buildings may have to be separated and some sort of continuous conveyor or moving platform may be desirable for getting goods from one building to the other. Conveyors of this sort may be especially desirable in connection with multiple-story wharf sheds, where the alternative would be lowering the goods to the ground floor and hauling them from one building to the other.

Access to Warehouse — Access to the warehouse for the different types of transportation units should be had at a number of points to avoid congestion. Trucks may back up to the outside of the warehouse from the street or enter it by driveways. Virtually all warehouses are accessible to street trucks, but many do not have railroad service and probably only a comparatively few are on the waterfront and so accessible to lighters.

Communication Between Floors — Both inside and outside communication between floors have their advan-



Freight "Transveyor" in Use at Port Newark Transferring Freight Between Quay Shed and Barge — Note Adaptability to Tractor and Trailer Feed

tages, but in general the Commission believes that the best means of intercommunication between floors is by elevators carrying the load on trailers. The elevators should be large enough to carry several trailers if not a full train. Inclined elevators, barrel and other vertical conveyors and chutes all have great usefulness at certain points for certain purposes, and should be liberally installed. Their carrying costs if they are properly designed and operated will usually be amply repaid in the saving of time and labor.

Tiering and Detiering or Reclaiming — Piling or tiering machines, and their complement, detiering or reclaiming machines, are needed to make full use of the capacity of warehouses with high ceilings, used for goods of low specific gravity. Modern practice for warehouses designed to store heavy as well as light materials favors a clear head-room of about 10½ ft. between floor and ceiling at each story. Such clearances, with the 2-ft. clear space under the ceiling required by the fire underwriters for the proper working of the automatic sprinkler systems, reduce to 8½ ft. the usable vertical space per floor for storage purposes and thus render tiering machines less essential.

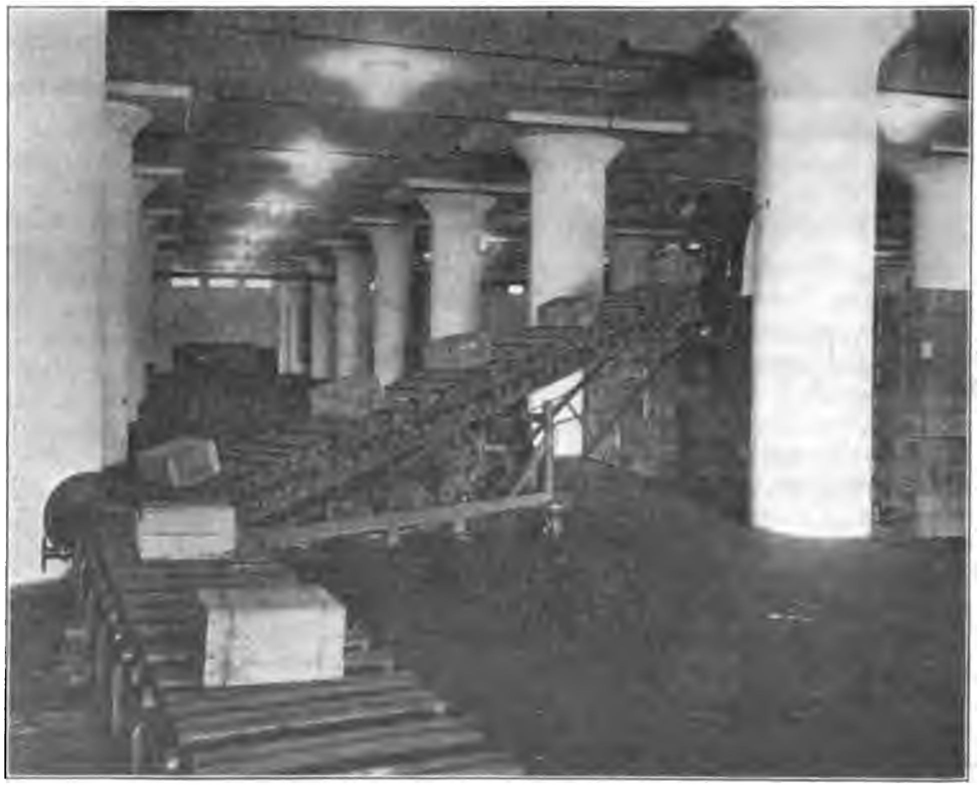
Much ingenuity has been expended in the design of tiering and detiering machines. An interesting type is used in cotton warehouses in New Orleans; traveling on a monorail system, it takes a bale out of a pile without upsetting those above it. A good machine for warehouses with high ceilings is the portable inclined conveyor, which takes the package at the floor or track level and delivers it to any desired height. Illustrations are shown of this and other types of machines.

Weighing — Scales should be installed in warehouses at such points and in such numbers as to prevent congestion and minimize haul of the goods, and of such sizes and capacities as are dictated by the commodities to be handled and by the customs requirements.

A considerable percentage of the warehouses are for cold storage. The Commission does not perceive any outstanding handling-machinery needs of warehouses of this type not applicable to warehouses in general. Facilities that minimize the rehandling of refrigerated food products will of course tend to conserve such products.

Customs Weighing

Customs weighing has been mentioned. This affects nearly all articles brought to this port from foreign countries. Imports are collected by the Federal Government on a basis of either value or quantity, duty on such articles as diamonds being made according to the value, while the tariff on articles of relatively low value is in



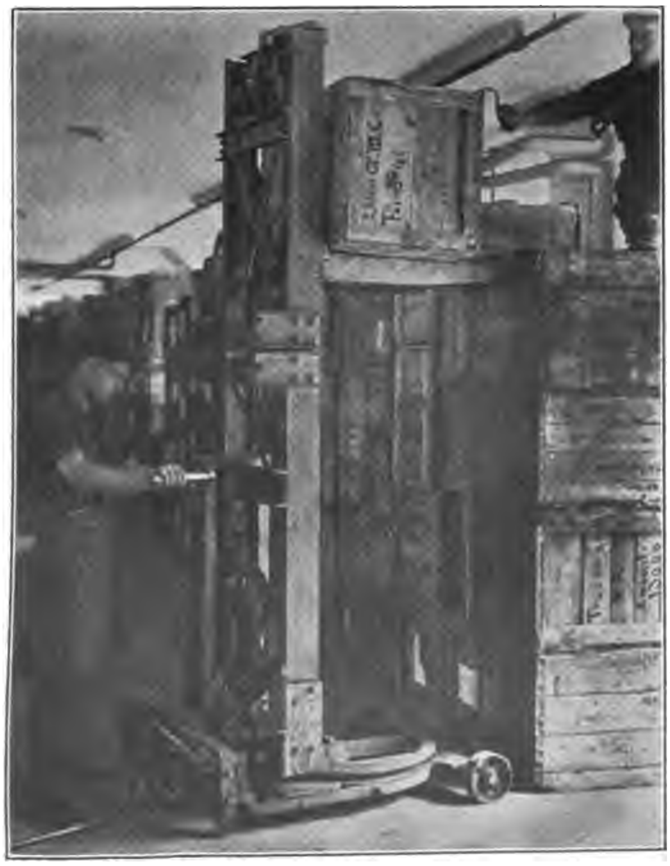
Portable Tiering Machine in Use at Brooklyn Army Base — Note Angular Transfer

"Micro Leveling" Operatorless Elevators at Brooklyn Army Base

general based on the quantity of them. For most kinds of imports the quantity is arrived at by actual weight, reduced to bushels or other measurement basis for calculation of the duty in terms of units of measurement of assumed weight. The correct weight of all articles on which duty is to be collected is arrived at by actually weighing them in lots of convenient size.

Fixed installations for weighing may be made in the case of such commodities as sugar, which are unloaded at a certain few points, but the greater part of the weighing is done on portable scales of small size which are erected and used at the point of greatest convenience, usually somewhere on the pier, but sometimes on the upland back of the pier. As the articles are unloaded from the ship they are taken to the scales and weighed by hand, two men being required at the scales to change the weighing drafts, in addition to the Government employees there to balance the beam and record the weights.

Conducted in this manner, customs weighing tends to discourage the use of mechanical contrivances. Goods can be hand-trucked to the scales, weighed and hand-trucked on to the point of deposit without seriously breaking the continuity of the operation, but continuous-motion machines are not adapted to this interruption. The Government authorities will not permit much deviation from this present procedure. While railroads ordinarily weigh their cars as they are in motion over the scales, to arrive at the transportation tariff on their contents, no such weighing in motion is permitted by the customs officials. Furthermore, if the commodity is subject to shrinkage or other change of dutiable characteristics, the Government will not permit weighing to be deferred until a more convenient time. For example, a certain grade of sugar arriving in large quantities could perhaps be unloaded from the ship and stored in an adjacent warehouse by continuous-motion mechanism, weighing being done when the stock was removed piecemeal from the storage pile. This would involve much less expense than by unloading, weighing and storing by present methods; but under present rulings neither the weighing of the sugar while in motion nor its storage prior to weighing will be permitted, the former on account of possible deviation in the true from the indicated weight.



Portable Vertical Tiering Machine — Hand Operated

The Commission urges upon the Federal authorities a modification of the rules in the interest of the great economies that might result therefrom. It is believed that if tractors were permitted to haul trailer trains over floor scales, or if the trailer trains could be uncoupled or pushed or dropped by gravity across the scales and weighed in motion, the errors in weight would be insignificant.

Stevedoring by Contract

Another deterrent to the installing of more elaborate machinery for handling ship's cargo, or more efficient use of existing machinery, is the practice at the Port of New York of stevedoring by contract. (At other ports other distinctions are made, and better sustained by the dictionaries, between stevedores and longshoremen; but in the parlance of this port longshoremen are the laborers who take part in the transference of cargo, while stevedores are their employers, and the men or companies who do business with the steamship companies.) Possibly half of the transoceanic ships are unloaded and loaded at this port by the ship's crew or other labor employed direct by the steamship companies. The remainder is done by contract between the company and the stevedore.

Until recently it was the general practice of stevedores to make contracts on a per-ton basis. In the last two years, however, the tendency has been toward a cost-plus-percentage basis. In either case the stevedore has not the incentive to effect a quick turnaround that the owners of the ship would have. On the per-ton basis the stevedore's interest is to keep down the labor costs, and he will do this at the expense of considerable time. On the cost-plus basis, on the other hand, his incentive to keep down the labor cost is removed, but he has no special inducement to use his labor efficiently.

The longshoremen have powerful labor organizations. Educational methods will need to be employed to show that the use of cranes will not be disadvantageous to the members of the organization, through reduction in total number of men employed or the setting up of grades and distinctions between the men. Naturally the stevedores, having no investment in the ship, have less incentive to conduct such educational campaigns than the owners themselves would have.

Under present conditions there are good reasons for stevedoring by contract. The stevedores can maintain a labor force and work from ship to ship and pier to pier, while the operating steamship company could not very easily keep its force uniformly employed. Concentration of shipping in certain well-defined areas would, however, tend to bring together the operations of each company and so make it easier for the larger companies to handle their own stevedoring contracts, which, by providing a scale of payment varying inversely with the time consumed, would give the contractor a definite incentive to despatch.

Ownership of Wharves

One other condition bearing more or less upon the freight-handling problem is the ownership of the wharves at the Port of New York. The great foreign ports are mostly under the control of public administrative bodies, which, with broad powers and control of the waterfront, are able to give all steamship and other companies using the waterfront equal opportunities, and which can assign their freight-handling machinery accordingly. The cranes are there for such tenants as care to use them. The waterfront is more limited and more intensively used, and there is little danger that the equipment will long be idle even if not used by all ships that dock.

At the Port of New York, the waterfront is mainly under private control, through long-term leases from the City of New York with respect to a considerable part of Manhattan, and through direct ownership of the remainder of the Manhattan waterfront, nearly all of that of Brooklyn, Queens and the Bronx and practically all of that on the west side of the Hudson River. In either case the freight-handling equipment is substantially that desired by the user of the pier. Without more definite control of the waterfront the various port authorities could not afford to install machinery that might not be used.

Conclusion

In conclusion, the Commission cannot subscribe to the popular view that the Port of New York is far behind the times in the matter of freight-handing machinery, nor can it offer the wholesale installation of cranes or other equipment as a panacea for the ills of the Port. It feels that the design and location of the pier itself, its accessibility, its warehouse facilities and its method of operation all share with its machinery the responsibility for the slow or rapid transferring of cargo. At the same time the Commission perceives ample opportunity for improvement in the matter of machinery.

Piers for general cargo should be designed in the future wide enough and strong enough to carry cranes of about 3 tons capacity, the nature of the traffic to determine whether the cranes should be at once installed. On certain existing piers handling general cargo, also, cranes could be installed to advantage, although such installation should be preceded by careful study both as to the need for the cranes and the suitability of the piers for them. Tractors and trailers should be more extensively installed, in transit sheds and warehouses. In the case of warehouses a liberal investment in large elevators, conveyors, chutes, tiering machines, outside hoists or whatever other machinery is called for by the design of the building and the nature of the goods handled will usually be profitable through reduced labor costs. Better waterfront equipment, such as cranes and grab-bucket hoists, is needed for loading and unloading barges, particularly canal barges, and in some quarters for handling special commodities in large quantities.

Besides these and other improvements possible in in the way of physical equipment of the Port, the Commission urges upon those in a position to effect them the desirability of other changes touched upon in this chapter, such as provision of more tackle on many ships seemingly inadequately equipped, reduction in the allowance of free storage, modification of stevedoring contracts to furnish more incentive for despatch, and revision of the customs-weighing rules to permit more continuous movement of goods from ship to point of deposit.

CHAPTER 28

Handling of Fuel

Fuel dwarfs all other commodities at the Port of New York in the volume of the movement, and the Port is absolutely dependent on a continuous supply of it. That dependence can perhaps be best expressed in tonnages compared with the tonnages of other commodities.

Of the 66,000,000 tons of freight brought to the Port District by rail in 1914, 38,300,000 tons were coal, which constitutes the bulk of the fuel. At 45 tons per car, the movement probably required 850,000 cars, or upward of 6,000 miles of cars. About 3,800,000 tons, or more than 8,000 carloads, were delivered to and consumed by the public utilities on which the district depends for light and rapid transit — an amount about equal to the total deliveries by the railroads during the year of perishable foodstuffs. Nearly three times this amount was delivered for other local consumption, by the homes, public buildings, office buildings and factories of the district or by the railroads themselves. Upward of another 5,000,000 tons were delivered for consumption by floating craft — either local craft or sea-going vessels, and a still larger quantity was transferred from car to vessel for transporting to some other point.

A study of the fuel problem of the Port must necessarily, therefore, embrace many phases, such as the facilities for unloading the coal from the cars, the means of delivery to public utilities and to private enterprises, the system of supplying ship's bunkers, the prevailing methods of handling oil. The main conclusions of the Commission are that the railroad facilities for delivering coal either for local consumption or reshipment are adequate, that the general methods of local distribution by coal companies are satisfactory in the main, and that the custom of bunkering ships from barges at their berths is well adapted to the conditions at the Port, but that the large power plants could better be located in New Jersey to eliminate the costly water delivery of their coal, and that a central bunkering plant where certain ships could receive their coal direct, and more machinery for bunkering at the piers, would reduce the bunkering costs.

Amount and Disposition of Coal Handled at the Port

Virtually all of the coal brought to the Port comes by rail. The part played by the individual railroads in the movement is indicated in Fig. 13 of Chapter 6, page 148. The approximate disposition of the coal brought in in 1914 is set forth in Table 1. The deliveries to Manhattan, to Brooklyn and to New Jersey and Staten Island for local consumption, to other railroads or to vessels for delivery to other points, and to vessels for their own consumption constitute six totals, each of which equals or exceeds the total rail movement of foodstuffs other than grain or mill products; each of which also practically equals or exceeds the Manhattan pier and inland station tonnage that the automatic-electric system, if in operation in 1914, would have been called upon to handle. The Manhattan total, which embraces the Bronx and Yonkers, is the largest; the New Jersey and Staten Island total is the smallest, although practically all of the coal comes to that section originally.

Table 1 — Disposition of Coal Shipped to Port of New York by Rail in 1914

Destination	Quantity, tons	
Manhattan*		
Delivered by rail	500,000	
By car float	500,000	
By barge	7,500,000	
By truck	500,000	
		9,000,000
Brooklyn†		
Delivered by car float	500,000	
By barge	6,000,000	
		6,500,000
New Jersey and Staten Island		
Delivered by rail	3,100,000	
By barge	1,400,000	
		4,500,000
Through by rail‡		5,000,000
Shipping for delivery elsewhere		
Coastwise	7,000,000	
Export	500,000	
		7,500,000
Bunkers (ships and tugs)		5,800,000
Total		38,300,000

* Including the Bronx and Yonkers.

† Excluding about 1,700,000 tons delivered by car float in interchange to the Long Island Railroad at Long Island City.

‡ Interchange between the New Jersey railroads and the New York, New Haven & Hartford or the Long Island.

Of the total of 38,300,000 tons, 5,000,000 tons, constituting the railroad interchange of coal, were carried through the Port District in the original cars. Of another 5,100,000 tons, 3,600,000 tons were delivered direct by rail, 1,000,000 by rail through the medium of the car float and 500,000 through that of the truck. The cars involved in the movement of these 5,100,000 tons were unloaded at various points in the Port District, presumably in the main at coal trestles or pockets of more or less standardized type.

The remaining 28,200,000 tons were transferred from the cars to floating craft. The distribution of the tonnage is indicated in Table 2, which is derived from Table 1.

Table 2 — Amount of Coal in Tons Delivered to Floating Craft at Railroad Coal Terminals During 1914

Destination	Tonnage
Points within Port District	14,900,000
Points outside Port District (coastwise and export)	7,500,000
Bunkers for consumption by vessels	5,800,000
Total	28,200,0 0

Facilities for Unloading Coal Direct from Car to Vessel

There are in the Port District fourteen coal terminals, situated on eight different railroads, all on the New Jersey or Staten Island waterfront. They provide eleven car dumpers and eighteen trestle piers. The trestles are high structures carrying railroad tracks. The cars are elevated to the trestle tracks by one means or another and unloaded through their own hoppers or by hand shovelling into hoppers on the piers, where chutes lead to the vessels. The car dumper, of which several have been built at the Port within the last five years, is a more modern device. As its name implies and one of the accompanying photographs shows, it takes the car bodily, tilts it and pours its contents into a pan from which the coal is spouted into the vessel.

Table 3 shows the ownership, locations and character of the facilities for this car-to-vessel transfer of coal.

Table 3 — Terminals and Facilities at the Port for Transferring Coal from Cars to Vessels

Railroad	Location of terminal	Facilities	Kind of coal handled*
B. & O.	St. George	Small car dumper Two trestles	B
	Arlington	New car dumper	B
C. of N. J.	Jersey City	Two new car dumpers Trestle	A and B
	Port Liberty	Trestle	B
	Port Johnson	Trestle	A
	Elizabethport	Two trestles	A and B
D., L. & W.	Hoboken	Two car dumpers	A
Erie	Undercliff	Car dumper Two-sided trestle One-sided trestle	A and B
L. V.	Perth Amboy	Car dumper Trestle	A
N. Y., O. & W.	West New York	Trestle	A
Pennsylvania	South Amboy	Two car dumpers Small trestle	A and B
	Harsimus Cove	Trestle	B
	Greenville	Trestle	B
P. & R.	Port Reading	Car dumper Three trestles	A and B

* A indicates anthracite; B indicates bituminous.

Five of the terminals handle both anthracite and bituminous coal, five handle only bituminous and four handle only anthracite.

There are warming houses for thawing out frozen coal at Undercliff, Jersey City, Arlington, Port Reading, Perth Amboy and South Amboy, and steaming facilities for the same purpose at West New York and Hoboken. These are an important feature; even with them during the severe winter of 1919–20 there were times when it was very difficult to get the coal out of the cars fast enough to supply New York's needs.

The combined daily average capacity under normal conditions of all of the facilities comprising these terminals is approximately 3,200 cars. At 45 tons per car this means 144,000 tons. Under winter conditions, usually lasting four months — from December to March inclusive — these capacities are reduced to a daily average of about 2,000 cars or 90,000 tons. As a rule the coal transfer is carried on through the winter 24 hours a day, week days and Sundays, provided sufficient coal is available to warrant continuous operations.

On this basis the yearly capacity approximates 840,000 cars or 37,800,000 tons. As has been seen, the total amount of coal handled in 1914, which is regarded as a normal year, was approximately 28,000,000 tons. It is apparent, therefore, that the facilities are not continuously worked to full capacity and that except possibly at certain peak periods during the winter months the combined capacities are much greater than present-day needs require. While the facilities are worked more nearly to capacity during the winter season, it not infrequently happened last winter that there was not sufficient coal available at some of the terminals to permit of a full day's work.

Weather conditions that slow up coal-handling operations at tidewater also affect mining operations and transportation conditions. In winter, for example, the coal barges frequently become frozen into the slips so that it is impossible to move them. Fog and labor troubles contribute further to the slowness and uncertainty of local deliveries. The best safeguard against coal shortage is the provision of storage, and the most effective storage is in the cellar and stockpile of the consumer, not at the mines or at the railheads of the Port, for rehandling and winter conditions of delivery kill the effectiveness of the last two methods of storage. That some of the large public service companies have not room to store coal for many days at their plants is an argument for relocating the plants in New Jersey, where they would have room.

Fuel Supply as Related to Power Output

There are nine principal public service companies generating electricity in the Port District, as stated in Chapter 31 on electric power supply — the New York Edison Company, the Interborough Rapid Transit Company, the Hudson & Manhattan Railroad Company, the New York Central Railroad Company, the Pennsylvania Tunnel & Terminal Company, the Brooklyn Rapid Transit Company, the Brooklyn Edison Illuminating Company, the Richmond Light & Railway Company, and the Public Service Corporation of New Jersey.

These companies' plants, of which there are thirty within the District, consume in the aggregate an amount of coal estimated at 3,800,000 tons annually. Of the whole amount the New York Edison Company and its allied companies burn about 1,000,000 tons a year. A large part of this amount is used at the two Waterside stations situated on the East River at Thirty-eighth Street. The other companies mentioned in the preceding paragraph consume the remainder — from 50,000 to 500,000 tons or upward per company.

Nearly all of these thirty electric power plants are alongside navigable water, and nearly all receive their fuel supply by boat. Elaborate handling machinery has been installed at the majority of the plants, so that the expense of the actual transfer of the coal from barge to coal bunker at the plant has been reduced to a minimum. There is nevertheless a heavy expense involved in towing barges to the plants, and in the majority of instances there is an extra handling due to the loading of the barges at Perth Amboy or some other railhead within the Port District. The Edison Company also maintains a stockpile as a reservoir on the New Jersey shore, and the use of this involves still another rehandling.

NEW JERSEY THE IDEAL LOCATION FOR POWER PLANTS

The joint marginal belt-line railroad system recommended by the Commission will give all of the coal-handling roads access on equal terms to virtually all of the New Jersey waterfront. The Commission urges that future power plants for all parts of the Port be established on the New Jersey side of the Hudson River, alongside or within easy reach of the belt lines so that cars can be brought direct to them. They can at the same time be on the waterfront to make available the alternative of barge service. The power can be transmitted by electric conduit under the Hudson and other harbor waters to substations placed where needed.

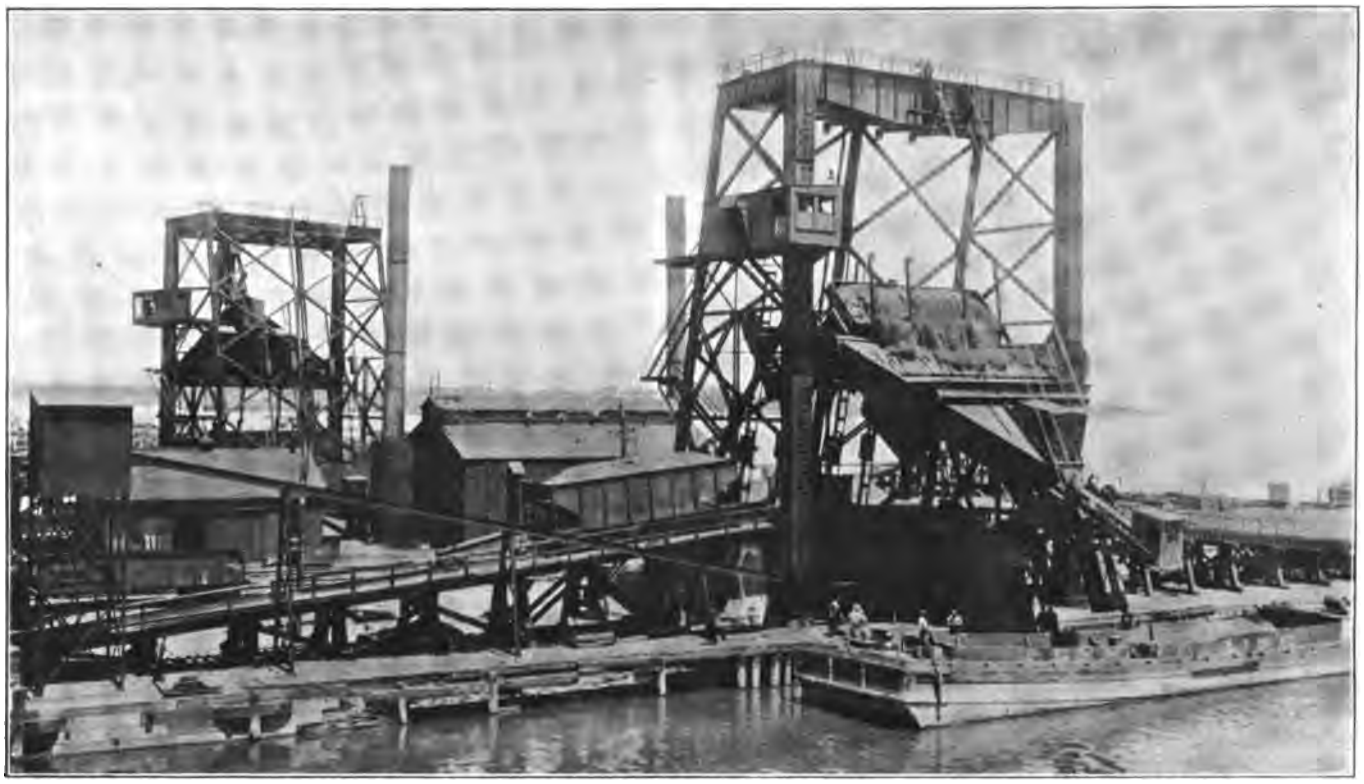
Strong arguments for removing this dependence on water deliveries of fuel have been afforded since the Commission began its investigation. The existing stations, particularly those in Manhattan, naturally have no considerable space available for coal storage, and require continuous delivery of their coal. During the strike of the marine workers last year some of the companies were hard pressed for fuel, and it is stated that only the eleventh-hour delivery at the Fifty-ninth Street station of the Interborough Rapid Transit Company of a barge of coal belonging to a New Jersey railroad prevented a suspension of subway service. Again during the past winter the transit officials expressed fear that their service would have to be discontinued because of their inability to get their coal, although there was considerable coal frozen in the cars in the New Jersey yards. This coal could presumably have been unloaded at plants on the New Jersey side.

Bunkering of Ships

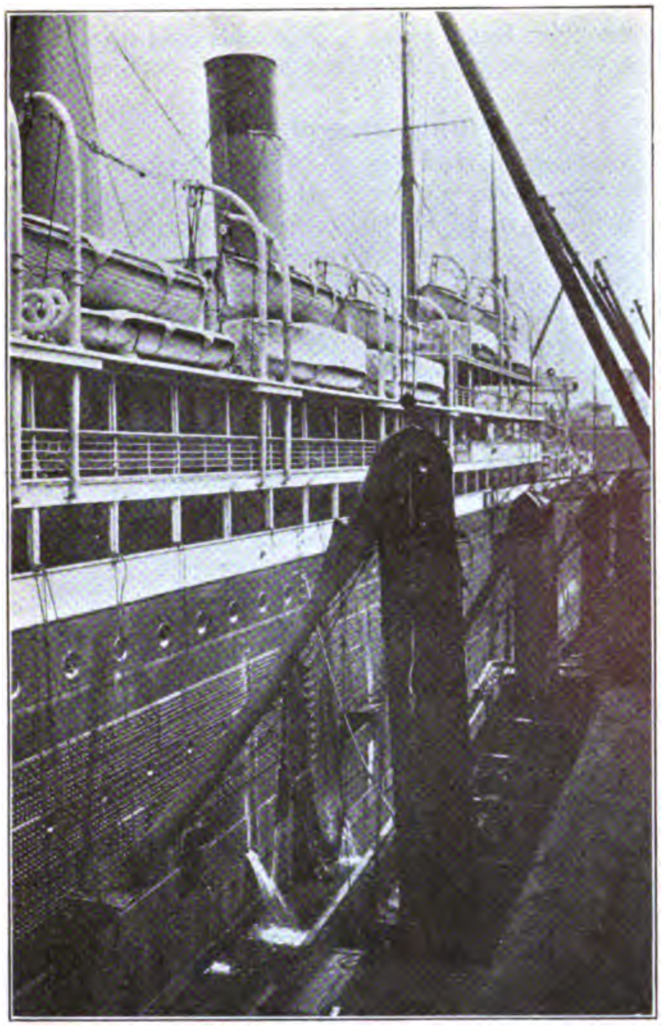
As has been shown in the foregoing tables, there is delivered at the Port to various craft for bunkering purposes about 6,000,000 tons of coal during the period of a normal year. This amount is made up of deliveries direct to craft operating within New York Harbor and small vessels in the Hudson River, Long Island Sound and coastwise trade, and deliveries to lighters and barges from which ships' bunkers are supplied.

There are comparatively few seagoing vessels that are coaled directly at railroad piers, either in bunkers or as cargo. In this respect New York is situated unlike the seaboard ports of Philadelphia, Baltimore and Norfolk. At Philadelphia coal is delivered direct to vessels in cargoes running up to 3,500 tons, to tramps of from 5,000 to 7,000 tons, and to an occasional collier of 12,500 tons. At Baltimore it is delivered to coastwise vessels with cargoes up to 6,000 tons, to barges of up to 7,500 tons, to tramps of from 5,000 to 7,000 tons and to colliers carrying up to 12,500 tons. At Norfolk it is delivered to vessels of practically the same capacities as at Baltimore. Some of the vessels in the New York trade go to other American ports for their coal.

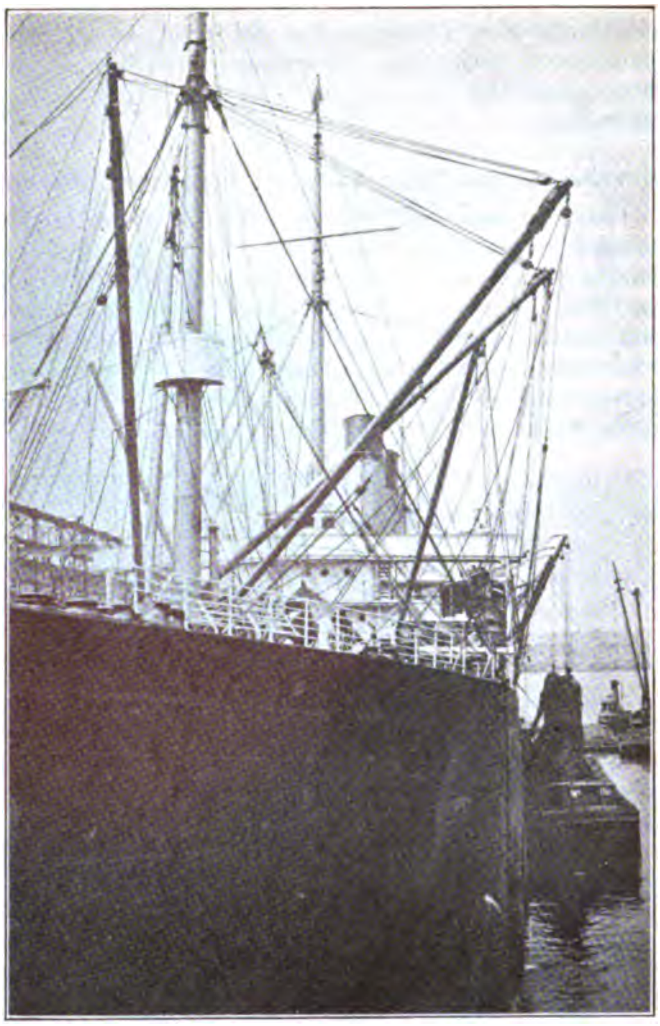
In a normal year about 8,000 vessels clear from the Port of New York. Approximately one-half of this number are vessels in foreign trade. Although the data touching on the subject are fragmentary, information obtained by the Commission's engineering staff



Car Dumpers Used in Transferring Coal from Car to Boat — Car Is Lifted Bodily, Overturned and Contents Poured Out — Cycle Sixty Cars per Hour



Bunkering Machines Transferring Coal from Barge to Bunker on Pier Side of Ship



Bunkering Machines Transferring Coal from Barge to Bunker on Offshore Side of Ship

shows that an average of 80 per cent of the vessels in the foreign trade receive their bunker coal at this port. The average amount of coal taken on per vessel is about 800 tons, although the maximum may run much higher. Probably 2,500,000 tons annually, or somewhat less than half of the coal delivered in a year to all craft for bunkering purposes, are put into the bunkers of vessels in foreign trade.

SHIP BUNKERING METHODS AT NEW YORK

It has been estimated that 90 per cent of the bunker coal delivered at New York to vessels in the seagoing trade is bought on a free-alongside-ship basis. Purchase is usually made by contract with coal sales companies specializing in the bunkering trade. Such coal is dumped at the railroad piers into barges operated by the coal sales companies. The railroad company bears the expense of handling over the pier, inasmuch as the tariff rate from the mine to tidewater includes delivery free on board a vessel at common-carrier piers. The coal sales company ordinarily completes its contract when delivery is made free alongside the ship. Certain of the sales companies contract to place the coal in the hold of the ship, and in such cases they as a rule employ mechanical means for conveying the coal from barges to the hold of the ship. This practice is not followed extensively, however; apparently not more than 10 per cent of the bunker coal is loaded upon the ship by special coal-handling machinery. The usual practice is for the ship owners to employ stevedores to load the coal by hand into buckets and use the ship's tackle to hoist the buckets over the side of the ship. The coaling is done on both sides of the ship, thus making breasting off necessary.

The cost of bunkering to the steamship company under the prevailing methods has been found to run anywhere from 60 cents to upward of $1 per ton. Under pre-war conditions the cost probably did not average more than the lower figure, but at the present time it usually exceeds the latter.

Consideration of the needs of the Port of New York in the way of bunkering facilities must take into account a number of elements entering into the situation. One of these is the diverse character of the self-propelled vessels using the waters of the harbor, from small craft with bunkering space for less than 50 tons of coal, through the gamut of river boats, Sound steamers, coastwise ships and tramps of various ratings clearing for ports all over the world, to the largest trans-atlantic liners. Another element is the variety of classes of trades the vessels serve — in some of which a quick turnaround is imperative, in others of which there is usually a lay period over and above that required for discharging and reloading cargo. Still another element is the extent of the Port, which embraces hundreds of miles of waterfront, with piers located in widely scattered districts.

CENTRAL BUNKERING PLANT — ITS DESIRABILITY AND LIMITATIONS

Reference has been made in Chapter 27 to the common and largely unwarranted belief that lack of freight-handling machinery has been a great impediment to New York's progress. The same feeling exists with respect to her bunkering methods. Those who decry the transfer of ship's cargo with ship's gear are usually equally condemnatory of the practice of coaling ships at their berths. They say the coaling should be performed direct at a central bunkering plant.

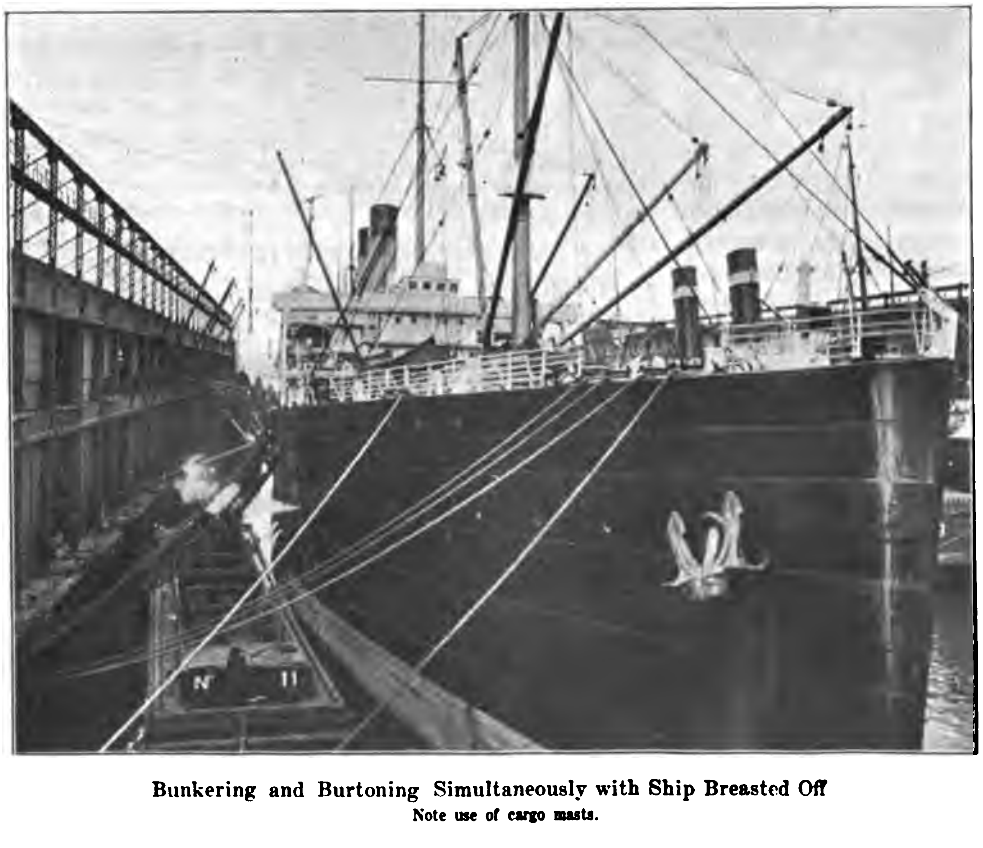
The Commission concurs in the desirability of a central bunkering plant, but believes the need for it and the extent to which it would be used have been overestimated. Ships operating on a schedule which necessitates the quickest possible turnaround would hardly use the plant, inasmuch as the loss in time would far overshadow any possible saving in the cost of coaling under present practices. All craft reporting at railroad piers for coal are treated alike and must await their turn for service — sometimes a matter of days — and only those that would otherwise be idle awaiting cargo or for other reasons could afford so to wait.

The carriers themselves might also demur at any extensive use of the facilities for the direct coaling of ships, inasmuch as it takes much longer to place a given amount of coal in the average ship's bunkers than in a barge, and the capacities of the plants would be greatly reduced if many ships attempted to avail themselves of the facilities. In fact, one of the railroads operating a modern plant at Baltimore has recently refused to allow ships to bunker there direct.

Recognizing these limitations, there is still ample argument for a central plant, under the control of a port authority that would permit its use by ships. Given immediate access to the plant, the average ship could probably coal in less than a day, and the saving to a vessel that would otherwise be idle at her pier would be well worth while. Even if the congestion at the plant were too great to permit the ships to take their coal direct, it would often be profitable to tow them to the vicinity of the plant and let them receive their coal in the stream from barges, thus reducing the towing charges. Such a plant would be a competitor of the existing coal terminals, some of which are inconveniently located for local deliveries, and as such would doubtless have a beneficial effect.

The central plant should be located at a point to which the coal could come from the uplands with the shortest haul, and at a point which would involve the least deviation from the average ship's course to her berth. Its design and capacity should be commensurate with the demand, further study being required to estimate that demand.

Assuming that the large number of ships having no idle time in port would continue to receive their coal from barges at their berths, the Commission urges the use of more in the way of economical machines for bunkering by this method.


Bunkering and Burtoning Simultaneously with Ship Breasted Off
Note use of cargo masts.

Handling of Oil

Oil comes to the Port in considerable quantities, though to no such extent as coal. It comes by rail, by vessel and by pipe line. A few large companies, located mainly on the Bayonne peninsula, control the input. The Commission has no criticism to make of the methods they employ in handling it.

The use of oil as fuel for ships, while of comparatively recent adoption, is assuming large proportions. Facilities for oil bunkering should therefore be provided at the central bunkering plant.

CHAPTER 29
Handling of Grain

A thorough reorganization of the methods of handling grain is imperatively required if New York is to compete successfully with other Atlantic ports for the export trade. The outstanding needs in the way of physical plant are a terminal elevator at the Gowanus Bay terminal of the New York Barge Canal, with the most modern equipment for "working" the grain, to receive grain shipped via the Barge Canal; elevators, with equally complete equipment, at some point on deep water reached, probably through the proposed exterior belt line, by all of the railroads from the West, and an elevator at Piermont, fcr the local distribution of grain, accessible to the Barge Canal and to the New Jersey railroads via the exterior belt line.

General

Grain is one of the most important single elements of commerce handled at the Port of New York. Approximately one-fourth of all the wheat consumed in the world is produced in the United States and Canada, and probably these two countries will always export large quantities of both wheat and other grain to other countries. The keenness of the competition of different ports for the moving of this grain is affected little by the international boundary line — Montreal being one of New York's chief rivals for both United States and Canadian grain. Philadelphia, Baltimore and other ports are also active competitors, and are providing new facilities, while New York has stood still until recently, when the State undertook the construction of an elevator at Gowanus Bay as part of the Barge Canal terminal at that point. It is mainly because New York has the preponderance of established transoceanic lines, whose ships carry grain as supplementary cargo, that she has been able to retain her volume of grain-export business; but the establishing of more lines at other ports will challenge that advantage.

There are three principal movements of grain at the Port of New York: Eastbound movement for domestic consumption, eastbound movement for export and inbound movement from the ocean. The first two overshadow the third in importance — the first because the inhabitants of the Port depend on it as an essential part of the food supply, and the second, which is much greater than the first, because it is an important item of the exports of the Port. Only a small amount of grain comes inbound from the ocean, flaxseed from South America, corn and wheat from various countries in years of poor crops. Some of the imported grain is re-exported.

In 1917 the railroads brought to the Port 143,421,100 bushels of grain, this figure including malt and peas as well as wheat, corn, oats, barley and rye. In the same year 33,268,505 bushels of domestic wheat and 33,957,299 bushels of other domestic grain were exported from the Port. The figures for Canadian grain exported from New York are not available, but in 1913 New York exported nearly as much Canadian as domestic wheat, so that it can be seen that the greatest part of the grain received is exported.

The distribution of export grain between different Atlantic and Gulf ports has varied widely in the last ten years, as has that exported from New York. Montreal and Baltimore are New York's keenest competitors, while Portland, Boston, Philadelphia, Newport News, New Orleans and Galveston all have large parts of the traffic.

Production and Physical Movement of Grain

Statistical data herein presented relative to the production and physical movement of grain have been drawn partly from figures compiled by the United States Department of Agriculture and reported by the New York Produce Exchange, partly from figures furnished by the Montreal Board of Trade and partly from other sources.

In the colonial days grain like other foodstuffs was produced locally. With the opening up of the interior of the country, the development of a large export trade in grain and the growth of New York and other communities to points where the demand for local consumption exceeded the producing powers of the near-by territory, distance has been obliterated, and the Central West, in both the United States and Canada, has become a vast grain-growing region, supplying not only most of the United States and Canada, but also a large part of the entire world. Wheat from North Dakota, for example, is shipped through New York, Montreal, Galveston or Seattle.

Grain-Producing States

Wheat, corn, oats, rye and barley are the principal grains grown in the United States. Buckwheat and flaxseed are produced in smaller amounts. According to the estimates made by the Department of Agriculture, the respective crops in 1918 and the areas planted to them were as shown in Table 1, as were the average crops for ten years, 1909 to 1918 inclusive. The averages for each grain except corn are lower than the 1918 figures, due to the fact that the war-time production of 1918 and other recent years was greater than that prior to the war.

Table 1 — Estimated Grain Crops and Areas Planted Thereto in the United States in 1918, and Average Crops for Ten Years

Grain	1918 Area planted, acres	 Crop, bushels	Average crop for ten years, bushels
Wheat	59,110,000	917,100,000	755,452,000
Corn	107,494,000	2,582,814,000	2,751,850,400
Oats	44,400,000	1,538,859,000	1,272,844,500
Rye	6,185,000	89,108,000	46,952,000
Barley.	9,679,000	256,875,000	198,086,900
Buckwheat	1,040,000	17,182,000	16,131,900
Flaxseed	1,938,000	14,657,000	*14,260,000
Total	229,846,000	5,415,590,000	5,055,077,700

* Based on six years, 1913–1918 inclusive.

Corn and oats are grown in every State, and wheat, rye and barley in a large majority of the States. Buckwheat is grown in twenty-five States, mostly in the northeastern section of the country, Pennsylvania and New York being the principal buckwheat States, and flaxseed is grown in eleven States, mainly in the western central group, North Dakota, Minnesota and Montana producing most of the flaxseed.

Corn— Seven central States constitute what are known as the surplus States. They produce more than half of all the corn crop of the United States. All of the territory south of them to the Gulf and east to the Atlantic, as well as all of the States to the north except North Dakota, also produce corn in large quantities in proportion to their area. Based on the Department of Agriculture estimates for the ten years, 1909–1918 inclusive, the average crops of the leading twelve States in order were as shown in Table 2.

Pennsylvania, Virginia, North Carolina, Georgia, Alabama, Mississippi and Wisconsin each come close to the last four States in the tables.

TABLE 2 — AVERAGE ANNUAL CORN CROP IN BUSHELS OF TWELVE RANKING STATES

Iowa	326,050,000
Illinois	318,898,000
Missouri	167,049,000
Indiana	163,426,000
Nebraska	159,617,000
Ohio	130,870,000
Texas	109,258,000
Kansas	100,617,000
Kentucky	88,930,000
Tennessee	78,285,000
South Dakota	76,086,000
Minnesota	75,932,000

Wheat— Table 3 gives the ten ranking States in the production of wheat, based on estimates for the same ten years. North Dakota, which produces little corn, leads in wheat, while Iowa, which leads in corn, is only about fifteenth in wheat. Washington, also, which produces little corn, produces much wheat. In the main, however, the heaviest corn States are also the heaviest wheat States.

TABLE 3 — AVERAGE ANNUAL WHEAT CROP IN BUSHELS OF TEN RANKING STATES

North Dakota	88,105,000
Kansas	80,063,000
Minnesota	57,168,000
Nebraska	51,001,000
South Dakota	43,100,000
Washington	42,072,000
Illinois	37,636,000
Indiana	34,447,000
Missouri	33,138,000
Ohio	32,921,000

Oats— Iowa and Illinois lead again in the production of oats, while all of the remaining eight ranking States are Central-Western States. Kansas falls just below Michigan. Table 4 gives the figures for the first ten States.

TABLE 4 — AVERAGE ANNUAL OAT CROP IN BUSHELS OF TEN RANKING STATES

Iowa	185,902,000
Illinois	165,420,000
Minnesota	104,885,000
Wisconsin	82,353,000
Nebraska	66,565,000
Ohio	65,085,000
Indiana	60,621,000
North Dakota	60,111,000
South Dakota	51,511,000
Michigan	51,494,000

Rye and Barley— Tables 5 and 6 give similar information relative to the rye and barley crops, but based on seven years, 1912–1918 inclusive. Wisconsin is the leading rye State, California the leading barley State. Minnesota and North Dakota follow them both closely, North Dakota in fact leading in rye production in both 1917 and 1918. No State produces rye in any such quantities as wheat, corn and oats are produced (although North Dakota produced 20,000,000 bushels in 1918), while five States produce nearly 60 per cent of the country's barley crop.

TABLE 5 — AVERAGE ANNUAL RYE CROP IN BUSHELS OF TEN RANKING STATES

Wisconsin	7,083,000
North Dakota	6,484,000
Minnesota	6,352,000
Michigan	5,402,000
Pennsylvania	4,663,000
South Dakota	3,900,000
Indiana	2,968,000
Nebraska	2,786,000
New York	2,280,000
Ohio	1,528,000

TABLE 6 — AVERAGE ANNUAL BARLEY CROP IN BUSHELS IN TEN RANKING STATES

California	37,600,000
Minnesota	35,798,000
North Dakota	31,738,000
South Dakota	24,984,000
Wisconsin	20,493,000
Iowa	10,428,000
Idaho	6,661,000
Washington	6,271,000
Kansas	5,471,000
Oregon	4,563,000

Summing up, Iowa and Illinois, because of their enormous corn crops, lead in the total production of all grain, each averaging more than 500,000,000 bushels annually, while Nebraska, Minnesota, Indiana, Kansas, Missouri, Ohio, North Dakota and South Dakota in about the order named each average more than 200,000,000 bushels.

CANADIAN PRODUCTION AND THE WORLD'S CROP

Canada produces more than a third as much wheat as the United States does. Saskatchewan, the principal wheat-producing province, grows on the average nearly as much as any two of our States, while Manitoba and Alberta also rank with the first ten States of this country.

Other grains are also grown in considerable quantities, though not to any such extent as in the United States. Table 7, compiled partly from Department of Agriculture reports and partly from data by the

TABLE 7 — GRAIN CROP IN BUSHELS IN CANADA IN 1917 AND AVERAGE FOR FIVE YEARS

	1917	Average crop for five years
Wheat	249,177,000	266,840,000
Other grain	454,253,300	451,259,060
Total	703,430,300	717,599,060

TABLE 8 — DOMESTIC AND CANADIAN CROPS IN BUSHELS OF WHEAT, CORN, OATS, RYE AND BARLEY FOR FOURTEEN YEARS

1890	2,660,755,890	1913	5,255,484,000
1900	3,776,866,623	1914	5,469,112,000
1908	4,773,172,000	1915	6,781,893,000
1909	5,071,789,000	1916	5,411,173,000
1910	5,338,730,100	1917	6,370,158,300
1911	4,980,678,000	1918	6,024,886,690
1912	6,217,462,000	1919	6,050,471,000

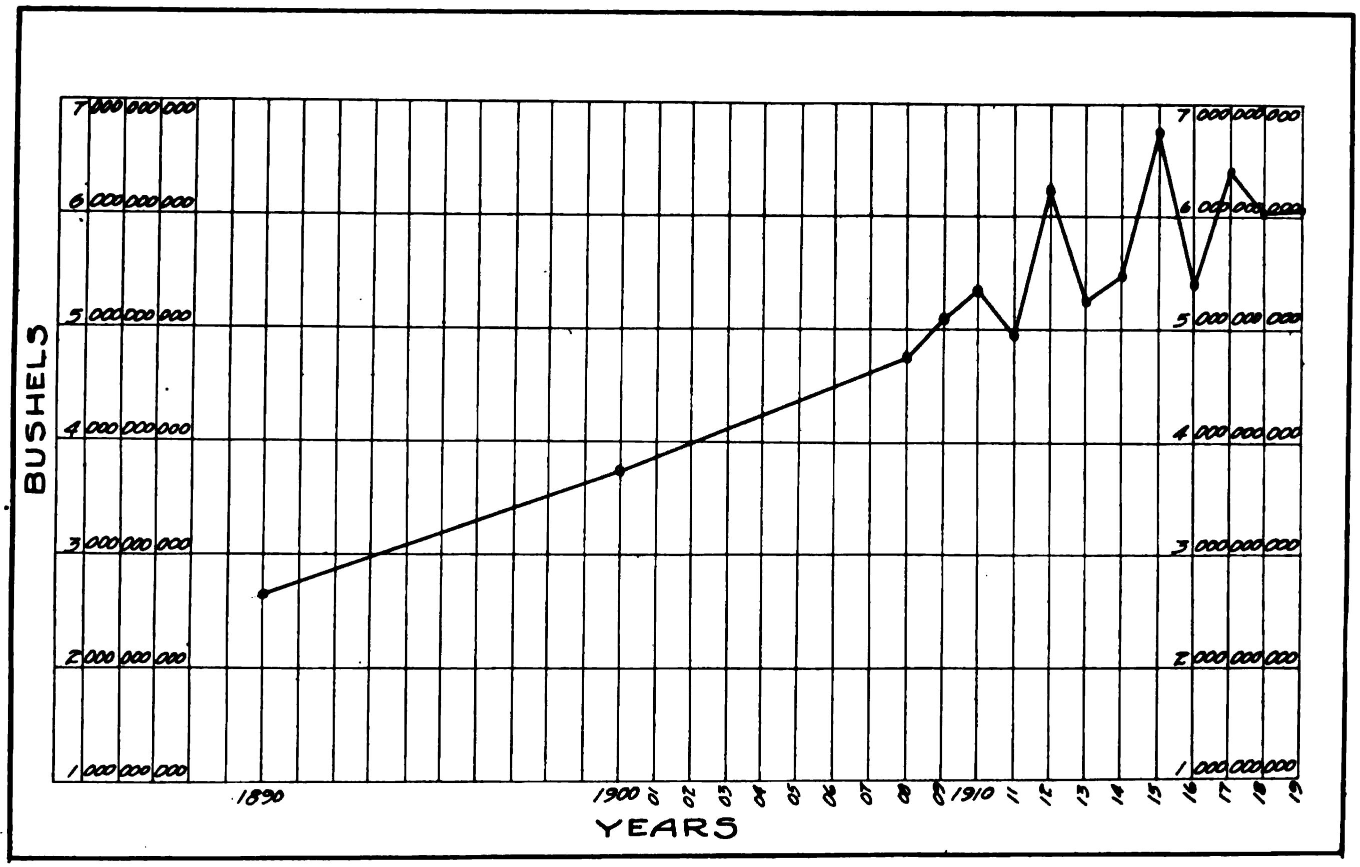


FIG. 1 — Total Crops by Years of Wheat, Corn, Oats, Rye and Barley in the United States and Canada

Montreal Board of Trade, affords a basis for comparison with Table 1.

Table 8 shows the total crops of wheat, corn, oats, rye and barley in the United States and Canada for a period of years, and the graphical presentation of this table in Fig. 1 shows the almost uniform increase in the total crop from 1890 to the present time.

Table 9 shows the wheat crops of the United States and Canada and of the world for a period of years, and shows the large part the two countries play in the world's supply. Similar figures for other grains were not available.

Of the world's crop of 3,500,000,000 to 4,000,000,000 bushels, Europe was producing more than half before the war. Russia was producing nearly as much as the United States, while France, with an average of more than 300,000,000 bushels, was exceeding the output of Canada, and Italy, Austria-Hungary, Germany and Spain were following in about the order named, each exceeding 100,000,000 bushels annually. Outside of North America and Europe the largest crops were grown in British India, which averaged about 350,000,000 bushels yearly, and Argentina, which averaged about half as much.

TABLE 9 — WHEAT CROP OF THE WORLD AND THOSE OF THE UNITED STATES AND CANADA

Year	World total bushels	United States and Canada Bushels	United States and Canada Per cent of total
1906	3,432,688,000	867,066,000	25.2
1907	3,133,965,000	726,778,000	23.2
1908	3,183,161,000	777,036,000	24.4
1909	3,583,019,000	903,933,000	25.2
1910	3,574,935,000	785,111,000	21.7
1911	3,538,794,000	837,256,000	23.7
1912	3,792,451,000	954,426,000	25.2
1913	4,127,437,000	995,097,000	24.1
1914	3,606,428,000	1,052,297,000	29.2
1915	4,127,686,000	1,452,548,000	35.2
1916	Not available	899,099,000	
1917	Not available	882,558,000	

Because of the war full figures have not been available since 1915. Therefore Table 9 is incomplete for 1916 and 1917, the latest years for which the Canadian figures were available when this chapter was written.

EXPORTS AND IMPORTS OF GRAIN

It has been asserted frequently that on account of the impoverishment of the soil and the diversity of crops less grain is being grown in this country and Canada than formerly. It has been further asserted that the exportation of grain from the two countries is decreasing, and that the time will soon come when existing facilities will be more than ample to take care of the movement. Table 8 and Fig. 1 dispose of the first assertion, and the second is refuted almost as effectively by Table 10 and Fig. 2. Table 10, with certain approximations for the earlier years, for which full data were not available, shows the amounts of wheat, corn, oats, rye and barley, both domestic and Canadian, exported from all United States ports and from Montreal each year for a period of thirty-four years. Fig. 2 is a graphical presentation of the last column of the table, with a second trend curve based on averages for five-year periods. The heavy increase in exports during the war was obviously

TABLE 10 — EXPORTS IN BUSHELS OF DOMESTIC AND CANADIAN GRAIN FROM UNITED STATES PORTS AND MONTREAL

Year	Domestic from U. S. ports	Canadian from U. S. ports*	Domestic and Canadian from Montreal†	Total
1886	148,201,216	‡	§	193,201,216
1887	131,774,387	‡	§	176,774,387
1888	85,558,172	‡	§	130,558,172
1889	131,534,797	‡	§	176,534,797
1890	150,842,484	‡	§	195,842,484
1891	175,845,209	‡	§	220,845,209
1892	215,476,121	‡	§	260,476,121
1893	177,128,672	‡	§	222,128,672
1894	117,345,518	‡	§	162,345,518
1895	134,342,123	‡	§	179,342,128
1896	268,826,175	‡	17,036,514	305,862,689
1897	377,755,786	‡	25,335,783	423,091,569
1898	426,744,361	‡	36,290,483	483,034,844
1899	378,649,662	‡	28,498,234	427,147,896
1900	335,964,831	‡	28,017,349	383,982,180
1901	318,701,235	‡	21,514,466	360,215,701
1902	167,735,081	26,140,714	20,198,846	214,074,641
1903	179,158,397	22,549,878	24,745,960	226,454,235
1904	69,313,852	8,715,329	13,254,083	91,283,294
1905	175,066,053	11,791,046	21,001,053	207,858,152
1906	206,451,702	23,568,375	22,808,043	252,828,120
1907	183,116,250	23,236,755	30,560,350	236,913,355
1908	140,979,919	24,258,823	29,313,713	194,552,455
1909	90,924,946	25,571,899	26,406,374	142,903,219
1910	77,163,135	26,207,660	26,607,635	129,978,430
1911	99,928,126	35,429,495	29,206,270	164,563,891
1912	131,677,754	63,708,796	38,561,921	233,948,471
1913	164,848,046	80,250,100	46,483,673	291,581,819
1914	250,610,380	58,859,602	74,908,366	384,378,348
1915	398,271,145	91,573,341	43,997,834	533,842,320
1916	336,651,072	181,483,093	70,192,881	598,327,046
1917	288,331,508	94,933,084	58,109,886	441,374,478
1918	291,975,984	30,921,017	59,798,500	382,596,501
1919	285,083,569	21,401,524	46,335,835	352,820,928

* From Portland (Me.), Boston, New York, Philadelphia and Baltimore.
† Via St. Lawrence River to Europe.
‡ Not available, but estimated at 20,000,000 bushels.
§ Not available, but estimated at 25,000,000 bushels.

abnormal, and that during 1896–1901 was also apparently not representative. Otherwise the curve of averages is almost horizontal, and there is certainly no evidence that the foreign trade is disappearing.

The proportions of the five principal grains exported are available only with respect to the domestic grain shipped from domestic ports. Table 11 shows the average amounts of such grain for ten fiscal years ended June 30, 1918. The figures are exclusive of wheat and rye flour and corn meal, which in the same period averaged about 14,000,000 barrels or perhaps 60,000,000 bushels. From 20 to 90 per cent, averaging perhaps 40 per cent, of the wheat goes out as flour. An average of 11,500,000 pounds of bread per year is also exported.

TABLE 11 — APPROXIMATE AVERAGE ANNUAL EXPORTS OF DOMESTIC GRAIN IN BUSHELS FROM THE UNITED STATES

Wheat	97,000,000
Corn	43,000,000
Rye	6,000,000
Oats	43,000,000
Barley	14,000,000
Total	203,000,000

Table 12 shows figures corresponding to Table 11 for such grains as were imported, based on six calendar

TABLE 12 — APPROXIMATE AVERAGE ANNUAL IMPORTS OF GRAIN IN BUSHELS TO THE UNITED STATES

Wheat	11,000,000
Corn	6,000,000
Oats	4,000,000
Total	21,000,000

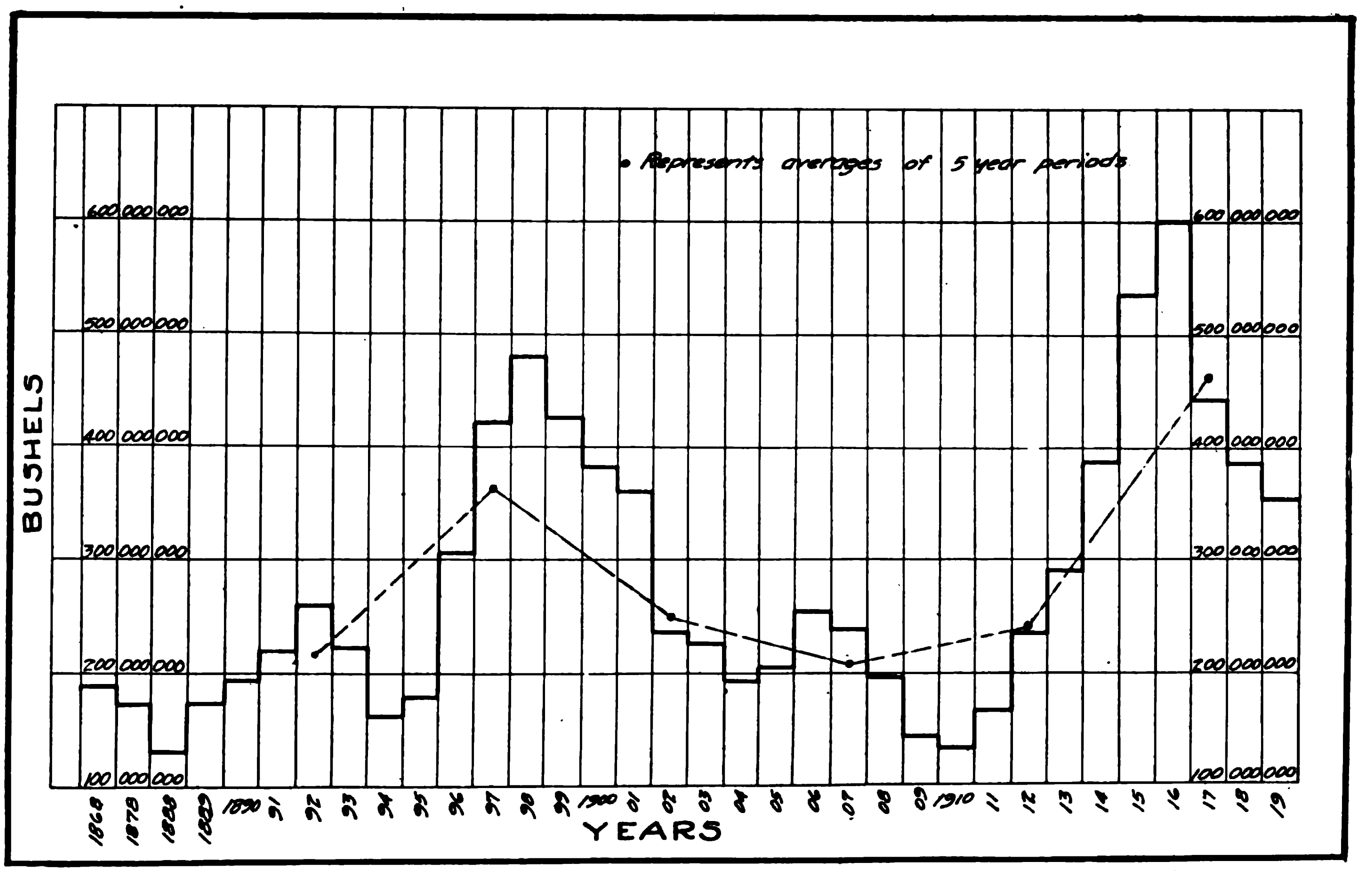


FIG. 2 — Exports by Years from the United States and Montreal of Wheat, Corn, Oats, Rye and Barley

years ended 1918. It shows that the importation is small compared with the exportation. About 1,800,000 bushels per year of the imported grain was reexported.

Figures assembled by the Department of Commerce for some twenty years ended June 30, 1918, show what countries received the wheat, flour, Indian corn and Indian corn meal of domestic production each year from the United States. Prior to the beginning of the war in 1914 the United Kingdom was receiving more of all these products than any other country. From 1896 to about 1906 the United Kingdom took approximately 55 per cent of the wheat and wheat flour and 40 per cent of the corn and corn meal. From that time until the beginning of the war the percentages of both fell to about 34 per cent.

More than 50 per cent of the total amount of wheat exported from these six ports was Canadian wheat, despite the fact that the domestic crop was more than three times the Canadian crop. This is probably explained by the larger population of the United States and the consequent larger amount of wheat consumed at home.

TABLE 13 — EXPORTS IN BUSHELS FROM VARIOUS EASTERN AND GULF PORTS DURING 1912-1918 OF DOMESTIC AND CANADIAN WHEAT, CORN, OATS, RYE AND BARLEY

YEAR	Portland (Me.)	Boston	*New York	Philadelphia	Baltimore	†Newport News	Mobile	New Orleans	Galveston	‡Montreal
1912......	7,012,691	14,205,553	53,524,291	19,442,873	33,777,953	7,681,509	1,045,535	11,718,441	8,401,770	38,561,921
1913......	11,038,950	25,688,077	65,465,591	22,656,428	46,857,884	9,542,945	1,121,857	18,642,556	13,626,722	46,483,673
1914......	9,228,819	17,280,998	61,845,630	22,577,404	51,250,505	1,796,776	1,219,221	34,655,515	36,010,121	74,908,366
1915......	14,481,509	15,879,101	126,614,627	44,605,596	90,172,864	62,812,467	1,518,873	35,508,510	33,494,604	43,998,224
1916......	39,270,139	29,192,938	153,963,432	48,642,479	119,434,917	50,993,331	1,587,911	29,148,124	24,269,253	70,192,881
1917......	12,055,723	24,286,700	119,591,065	44,169,050	68,617,933	32,676,019	806,640	41,399,394	15,950,882	58,109,886
1918......	20,757,223	13,484,055	63,393,132	28,886,197	31,929,846	14,790,299	544,147	44,248,128	11,031,603	59,826,197
Total.....	113,845,054	140,017,422	644,397,768	230,980,027	442,041,902	180,293,346	7,344,184	215,320,668	142,784,955	392,081,149
Average...	16,263,579	20,002,489	92,056,824	32,997,147	63,148,843	25,756,192	1,049,169	30,760,095	30,397,850	56,011,592

* Includes imports re-exported. † Includes Norfolk for 1912 and 1913. ‡ To Europe via St. Lawrence river.

Netherlands, Germany and Belgium were the next principal consignees of wheat, each receiving perhaps 8 per cent of the total. The eastern provinces of Canada, France and Portugal received lesser amounts.

EXPORTS BY PORTS

Table 13 shows the exports by years from 1912–1918 inclusive of the five principal grains from the nine chief Atlantic and Gulf grain ports of the United States, and also from Montreal. Table 14 separates the exports from New York into five grains. Both tables include Canadian as well as domestic grain, and the New York figures also include a small amount of imports re-exported.

TABLE 15 — EXPORTS IN BUSHELS OF DOMESTIC AND CANADIAN WHEAT FROM MONTREAL AND FIVE OF OUR NORTH ATLANTIC PORTS DURING 1913

Port	Domestic wheat	Canadian wheat	Total
Montreal	*6,871,716	26,834,373	33,706,089
Portland	182,072	8,223,463	9,405,535
Boston	5,678,052	14,334,982	20,012,984
New York	†26,402,769	22,616,905	49,019,674
Philadelphia	7,164,386	12,797,843	19,962,229
Baltimore	13,350,162	12,690,009	26,690,009
Total for six ports.....	59,649,157	97,497,525	158,796,520
Total yield	763,380,000	231,717,000	995,097,000

* Via St. Lawrence River to Europe.
† Includes imports re-exported.

Further light on the amount of both domestic and Canadian grain that crosses the international boundary line before being exported to other continents is shed by Table 15. The table covers wheat only and applies to the year 1913.

LOCAL CONSUMPTION

Comparison of the receipts and exports of grain for a period of years at the Port of New York will give us some idea of the amount locally consumed. It indicates that the average yearly consumption is about as follows: Wheat, 8,000,000 bushels; corn, 4,000,000 bushels; oats, 13,000,000 bushels; rye, 80,000 bushels; barley, 800,000 bushels.

HOW THE GRAIN MOVES

Grain cannot move directly from the farmer's barn to the seaboard elevator, because of the commercial considerations of financing and handling sizable lots. As a rule the grain is delivered by the producers to one of the multitude of trackside elevators scattered through the grain-growing district. Some of these elevators are operated independently, while many of them are in the hands of large operating companies. A goodly portion of the grain is taken to the immense mills of the northwest and ground into flour or meal,

TABLE 14 — TOTAL EXPORTS FROM NEW YORK IN BUSHELS DURING 1912-1918 OF WHEAT, CORN, OATS, RYE AND BARLEY

YEAR	Wheat	Corn	Oats	Rye	Barley	Total grain
1912..............	38,240,639	5,078,788	5,704,534	190,472	4,309,858	53,524,291
1913..............	49,019,674	5,853,799	4,352,191	723,910	5,516,017	65,465,591
1914..............	40,859,575	3,910,139	10,568,667	1,846,345	4,660,904	61,845,630
1915..............	91,907,601	9,687,369	17,559,003	1,981,508	5,479,146	126,614,627
1916..............	115,508,960	8,078,678	18,090,293	865,659	11,419,842	153,963,432
1917..............	71,512,351	12,229,035	25,445,485	2,895,141	7,509,053	119,591,065
1918..............	28,924,324	6,008,778	18,482,467	4,260,204	5,717,359	63,393,132
Total..............	435,973,124	50,846,586	100,202,640	12,763,239	44,612,179	644,397,768
Average..............	62,281,875	7,263,798	14,314,663	1,823,320	6,373,168	92,056,824

so that it does not enter into this phase of our investigation. More of it, after a period of storage depending mainly on market conditions, is moved to one of the immense terminal elevators of the Middle West, at Chicago, Milwaukee, Duluth, Fort William or Port Arthur on the Great Lakes, or at one of a few inland cities, notably St. Louis and Kansas City.

At the Middle West elevator the grain — that is to say, such of it as is to be exported or consumed in the populous eastern district — may be stored for a period depending on the market and other conditions, or it may be immediately transferred for reshipment. If it is for export it may be loaded on cars and moved to any one of the ten or twelve ports from Montreal to Galveston that are equipped to handle it, or use may be made of the cheap transportation afforded by the Great Lakes, and it may be hauled partly or even wholly to tidewater by boat. Grain for local consumption at New York may come from the Middle West elevators wholly by rail, by Great Lakes steamers to Buffalo or some other lake port and thence by rail, or by Great Lakes steamers to Buffalo and thence by the New York Barge Canal.

FACILITIES FOR WORKING

Commercial practice calls for elaborate machinery for handling grain at the storage and transfer points. The up-to-date elevator must not only have bins for storing the grain for considerable periods and keeping wheat from oats and rye from barley, but it must have a large number of bins to accommodate shipments whose identity must be preserved. This grain is known as "I. P. grain" and constitutes a considerable percentage of the total. Other shipments received at the same time can be mixed, but machinery is required for mixing the grain and also for drying, cooling and otherwise "working" it, and there must be facilities for sampling and weighing it.

The requirements have given rise to the modern type of elevator, in which the grain is "elevated," by conveyors or suction pipes or both, from pits under freight cars or from the holds of barges to bins high in the air, whence gravity performs a large part of the work of moving it through the various processes and ultimately discharging it through spouts into the holds of ships or barges, or into cars or trucks. Gravity may be assisted en route by belt or other cross conveyors, or additional vertical conveyor or suction pipes. Cleaners, coolers, driers, separators, clippers and bagging machines may, in the most complete elevators, bring up a large total of equipment.

The Erie elevator at Jersey City, though lacking the complete and modern equipment of some of the new plants at other points, is typical of the facilities at the Port of New York. The grain is sampled and graded at the cars. Two tracks run into what is known as the work house, into which the cars are run in strings, the tracks being drawn and filled alternately. The grain is removed from the cars by gravity and power shovels into hoppers under the tracks, whence it is hoisted by vertical bucket elevators or suction pipes to the top of the building and there discharged into large receptacles called garners. From the garners the grain falls as needed into a weighing hopper, whence it falls through a system of pipes into the appropriate bin. When withdrawn from storage it is allowed to fall by gravity from the bin through a discharge spout into the barge or ship, or it may be elevated if necessary for discharge into a ship or for any horizontal distance which may have to be overcome, the conveying tubes being sloped for the purpose. Ships loading alongside the elevator carry no other kind of cargo.

Many variations are possible in this routine. The grain may be cleaned, cooled, dried, mixed or otherwise worked at any time between receipt and final delivery. For cooling and sometimes for drying it is run out into a cooler floating alongside in the south slip and finally elevated back into the bins. South American or other imported grains, having been unloaded from the ships into barges and brought to the elevator, are transferred into the elevator bins by means of a "marine leg" and conveyor gallery and finally loaded into lighters or ships alongside or into cars in the house for outward shipping. Salvage grain (which has been submerged and saturated) is brought to the drier in barges, and is dried, cooled and run into the bins. Grain in barges loaded at any other point in the harbor may be brought here for such working as is necessary.

Elevators are large, more or less isolated structures, and in the past they have been constructed largely of wood. In consequence numerous large elevators have been destroyed by fire, and as the individual plants are few in number, fires may seriously handicap the grain-handling capacity of the community. The recent tendency is toward fire-resisting construction.

ROUTES FOR GRAIN

The principal terminal elevators of the Middle-West district are on the Great Lakes. The Mississippi River has not been used to any extent for export shipments since 1903, and grain reaches the Gulf ports almost entirely by rail. A large part of the grain for the Atlantic seaboard, however, leaves the Middle-West elevators by water. New York and Montreal are the only tidewater ports to which the entire journey can be made by water; Montreal is the only one that can be reached by ships sailing from Chicago or Duluth, and only ships of small draft can make the entire trip to Montreal, as the depth of 14 feet over lock sills controls the draft.

There are several reasons why export grain from elevators at a few Middle-West Cities proceeds by such widely divergent routes. Evidently no port has a preponderating advantage over all others. New York, with almost 50 per cent of the country's export trade in general, has only 20 per cent of the grain trade. To learn why it does not have more we must compare facilities at the ports, routes to them, shipping conditions from them, rates, despatch and other conditions.

Facilities at New York

Facilities for handling grain at the Port of New York are inferior to those at a number of other ports. Other ports have large elevators with up-to-date equipment for loading ships with full cargoes of grain, or for placing grain as supplementary cargo without interfering with the transferring of general cargo. New York depends for similar service on stationary elevators that are mostly smaller, older and less adequately equipped than those at rival ports, together with an expensive floating-elevator service, and New York has until recently made no worth-while provision for utilizing the advantages of the Barge Canal as a grain-handling medium. New York, which is the focal point for liners, is bound to carry a large amount of grain as supplementary cargo on those liners. That is no reason why the Port should not make as strong a bid for the full-cargo traffic as Baltimore and other ports with few liners do. New York has remained dormant while the other ports have progressed.

The facilities of the Port of New York consist chiefly of three groups: Six elevators and a trestle owned by the railroads, used both in the export trade and in local distribution; about the same number of small private elevators used in local distribution, and a fleet of floating elevators which do nearly all of the loading of ships.

NEW YORK CENTRAL AND WEST SHORE ELEVATORS

The New York Central and its subsidiary, the West Shore, have the greatest combined capacity and probably the most efficient grain facilities at the Port. They consist of a fairly new and an older elevator on adjoining piers at Weehawken, and an old elevator at Sixtieth Street and the Hudson River, Manhattan. The two at Weehawken take the bulk of the New York Central's export grain, the Manhattan elevator being used largely for local distribution.

New Elevator, Weehawken — The new elevator at Weehawken, put in service in 1905, has a maximum storage capacity of 2,000,000 bu. and a working storage capacity of 1,500,000 bu. Ordinarily 100 cars can be unloaded into bins or boats in a 10-hour day, while 200,000 bu. can be discharged from the elevator's bins into barges or ships in the same length of time.

This elevator occupies the shore end of Pier 7, which is about 900 x 128 ft. The elevator is about 370 x 100 ft. It has a framework largely of concrete, concrete housing of the conveying system above the tanks, and brick walls. It contains very little wood.

Cars are run under part of the elevator on two tracks, discharging into pits under the tracks, whence the elevator machinery takes the grain up to the bins. Both tracks are continued on the pier about 400 ft. beyond the elevator. Seven or eight cars can be unloaded at a time from either track. There are twelve discharge tubes on the north side of the elevator and eleven on the south side. There is a marine leg (for reaching into the holds of barges and drawing out their cargo of grain) on the south side close to the east end. The south slip is used only for harbor craft. The north slip, which is between the old elevator and the new, is 225 ft. wide and deep enough for ships.

Electricity is the motive power for the elevator, power being derived from a plant on the upland which serves both the new elevator and the old one.

Old Elevator Weehawken — The other elevator at Weehawken is about thirty years old. Its maximum storage capacity is about 1,250,000 bu. and its working storage capacity about 700,000 bu. Thirty-five cars can ordinarily be loaded or unloaded in a 10-hour day, and 50,000 bu. can be discharged from the elevator into vessels in the same length of time.

The elevator is on Pier 8, which is about 900 x 155 ft. The elevator itself is about 320 x 100 ft., and the general layout is about the same as at Pier 7, including the projection of the two tracks out along the pier east of the elevator. The lower story of the building is brick, the body is tile, the conveying top is covered with sheet metal and the framing is wood. The plant is designed to accommodate eight cars on each track, but the spacing of pits is such that only four or five can be handled at one time. Ships can load at the south side, on which there are sixteen discharging spouts, some high for ships and some low for barges, while only harbor craft can use the north side, on which there are twelve spouts.

In general the old elevator is used only for the overflow. With the same operating force three times as much grain can be put through the new plant as through the old. In 1916 the quantities put through the two elevators were 32,000,000 bu. and 10,000,000 bu. respectively.

Sixtieth Street Elevator — The Sixtieth Street elevator in Manhattan, which is also about thirty years old, is intermediate in capacity between the two at Weehawken, having 1,500,000 bu. maximum storage and 900,000 bu. working storage capacity. It is built parallel to the river and about 43 ft. from it at a point where there are no piers. The main structure is about 350 x 94 ft. Three tracks enter it from the north but do not run through. It was designed to handle ten cars at a time, but can ordinarily handle only five of present-day size.

A paved driveway extends along the east side of the elevators, and spouts and chutes for delivery into drays are distributed along the entire side. Spouts on the west side lead to the water's edge, and a slip also runs in along the south end of the elevator. The water is nowhere deep enough for ships, however, either in the slip or alongside the elevator, and only barges and lighters load there. About half of the grain handled there is distributed locally.

This elevator, which is about thirty years old, was originally built entirely of wood, but has since been faced with brick and tile. It contains facilities for conditioning grain, but has neither drier nor cooler. It is well equipped for bagging grain, and a large part of the local grain leaves the elevator in bags.

As far as practicable the Weehawken elevators are used for the export business and the Manhattan elevator for the local distribution. This is not altogether feasible, however, for the reason that grain is often sold and its destination determined after it reaches the elevator.

ERIE ELEVATOR

Only one other elevator in the Port, that of the Erie Railroad at Jersey City, compares favorably in size and capacity with the three above described elevators. The Erie elevator, situated on a pier a short distance from the Erie passenger terminal, has a maximum storage capacity of about 1,500,000 bu. and a working storage capacity of about 1,000,000 bu. It is the oldest elevator at the Port, having been built in 1880, but is one of the busiest. The elevator can unload about 85 cars per 10-hour day and can discharge about 140,000 bu. in the same time into a ship or lighter.

The elevator is mainly of wood. It has two receiving tracks, each of which holds eight cars. It has a large number of small bins, and virtually all of the usual facilities of a terminal elevator. There is deep water on the north side of the pier only. There are numerous discharge spouts both sides of the elevator, a number of those on the north side being high to permit loading into ships. There is a marine leg on the south side of the pier, with an elevated gallery carrying a belt conveyor and leading to the elevator proper.

This elevator is leased to the Erie Elevator Company, which operates it as a public elevator.

LEHIGH VALLEY ELEVATORS

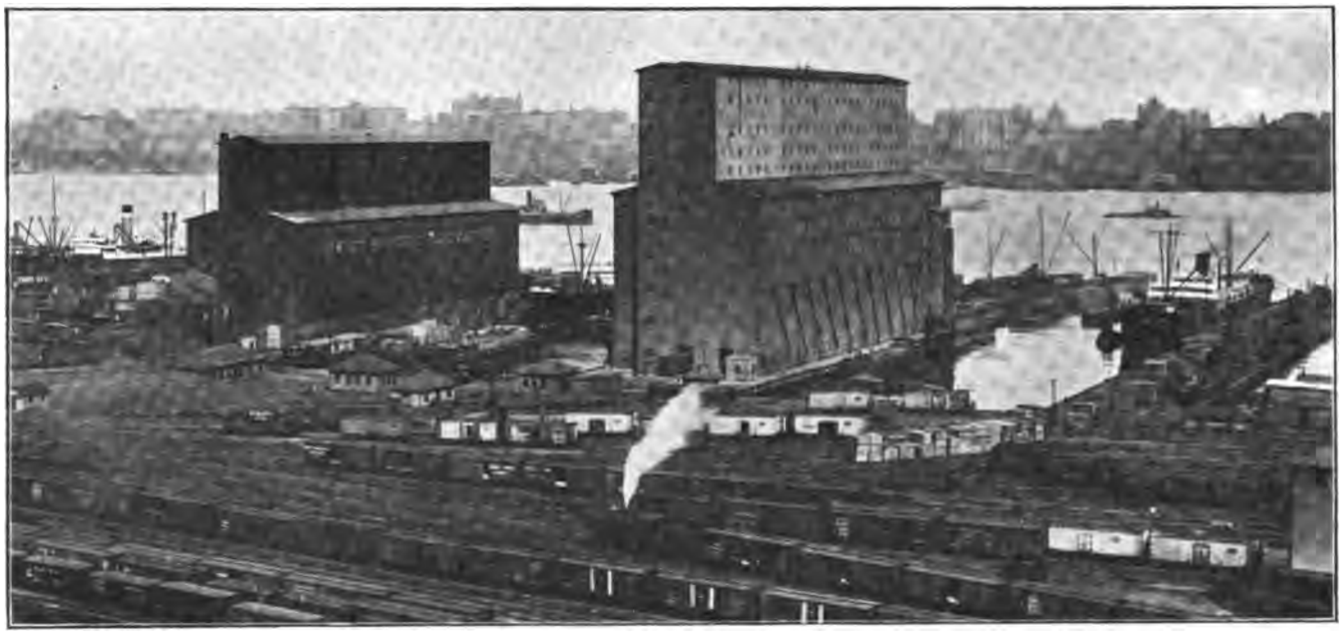
The Lehigh Valley Railroad has two small elevators at Black Tom. The older one, about seventeen years old, is a small frame building erected for the sole purpose of transferring grain from cars to barges. There are twelve bins for stabilizing the movement, but not of sufficient capacity for storage purposes. Two tracks lead into the elevator, and four cars can be unloaded on either track. On the water side are discharge spouts. An elevated conveyor gallery connects the older elevator with the newer one. Steam is the motive power.

The newer elevator was built in 1913. It is of reinforced concrete, with electricity as the motive power. It has a working capacity of from 250,000 to 350,000 bu. It has two tracks with pits for discharging grain from two cars at a time on either track. It has facilities for working the grain and bagging it.

Only barges can land alongside either of these elevators, and they are quite inadequate in size or capacity for any considerable volume of business.

LACKAWANNA GRAIN TRESTLE

Instead of an elevator the Lackawanna Railroad has an elevated grain trestle on a pier, with three discharging sheds. The cars are pushed up a steep incline at the shore end of the pier and there switched to either of two tracks, whence they run by gravity to the outer end of the pier. One of the unloading sheds holds three cars on each track; each of the other two hold four cars on each track. The cars can be stopped in any shed and electric shovels unload them into hoppers, whence spouts lead to lighters.



Grain Elevators in New Jersey Waterfront Yard — Ships Can Receive Cargo Here Direct

At the outer end of the pier the cars, still moving by gravity, are switched to a return track which brings them back to the shore.

These facilities are obviously serviceable only for the immediate transfer of grain from car to vessel. If the grain must be stored it is stored in barges. If it must be worked it is taken to the Erie elevator. The plant is not adapted to the loading of ships. It is capable of unloading from 100 to 150 cars per 10-hour day.

Each of these railroads has a fleet of grain barges, and each charters additional barges from time to time to handle the business. Grain is often stored in barges for a considerable period. The barges are used both in local distribution of the grain and in transfer of export grain to shipside, where it is handled by floating elevators.

A few years ago the Pennsylvania Railroad had an elevator at Jersey City. It was old and not very well equipped. With the completion of the large elevator at Philadelphia the Pennsylvania's grain business was diverted to that point, and the Jersey City elevator was torn down.

Private Elevators for Local Distribution

Table 13 gives characteristics of the five private elevators for local distribution recognized by the New York Produce Exchange. The five are similar in use.

Table 13 — New York's Private Elevators for Local Distribution

			Storage capacity, bu.	Transfer capacity per hour, bu.
Payne's	Foot of East 129th st., Manhattan	W. H. Payne	100,000	2,500
Brooklyn	Foot of East avenue, Hunter's Point	Brooklyn Elevator & Milling Co.	55,000	5,500
Clark & Allen's	Foot of East 32d st., Manhattan	Clark & Allen	275,000	3,500
Shaw & Truesdell	Second st. and Gowanus canal, Brooklyn	Shaw & Truesdell	100,000	2,000
Blake's	642 West 34th st., Manhattan	Thos. E. Blake	50,000	2,000
			580,000	

Part of Clark & Allen's plant is "regular" — that is, it is a public warehouse — but on account of its size, location and lack of certain facilities it cannot be properly considered available for any movement through the Port.

All of these elevators except Blake's have marine legs, storage bins and a few facilities for working grain. Blake's is reached only over the New York Central.

Floating Elevators

A necessary institution in the grain export business as conducted at the Port of New York at the present time is the floating elevator. Until some ten years ago virtually all of the grain exported from New York went in liners carrying general cargo. Such grain cannot be handled over the pier, nor can it be taken economically with ship's gear from barges. The floating elevator consists essentially of a hull which carries a marine leg and a system of discharge spouts. Grain barges are towed to the ship's side and the floating elevator runs or is towed alongside and transfers the grain over the side of the ship.

At present there are ten such floating elevators in the Port, of which six are self-propelled and four non-self-propelled. The majority of them are old, but not antiquated. Three of the number are able to load grain in the largest grain-carrying berth vessels that enter the Port. Some of them have a few facilities for working grain, while all have some means for weighing it. Each elevator has a transfer capacity of from 10,000 to 12,000 bu. per day.

These floating elevators are also used for unloading the small amounts of grain received at this port in ships.

At one time there were four or five companies operating floating elevators. There is now only one. It has been in continuous operation since 1891. It has prospered, but the Commission finds no reason to believe that its practices are unfair. The Commission believes, however, that any normal increase in the exports will be in full cargoes. At the same time the loading of general cargo and grain on lighters could be co-ordinated as at Montreal at several points by means of elevators on the upland reached by railroad cars, and connected with the piers by overhead conveyor galleries.

Proposed Gowanus Bay Elevator for Barge Canal

The law providing for the grain elevator at the Gowanus Bay Barge Canal terminal does not specify its size but implies that it shall be as large as can be built within the sum of $2,500,000 authorized. It is understood that there are contemplated two marine towers, storage for about 2,500,000 bu., galleries for conveying the grain out over the pier shed now being constructed, and a system of chutes from the galleries, as at Montreal. It is stated that the elevator will be of the latest and best design, that the entire storage space will be available for working the grain and that all suitable accessories will be installed. One feature is to be facilities for elevating grain from inbound vessels and loading it into canal barges for movement into the interior.

The initial contract is in force for channel excavation and construction of foundations.

Total Storage Capacity of the Port

Disregarding the capacities of perhaps 150 grain barges in which grain is stored for considerable periods in New York Harbor, the storage capacity in bushels of the Port's grain facilities is approximately as follows:

	Storage capacity
West Shore, two elevators	3,250,000
New York Central	1,500,000
Erie	1,500,000
Lehigh Valley, two elevators	400,000
Private elevators for local distribution	580,000
	7,230,000
Proposed Gowanus Bay elevator	2,500,000
	9,730,000

Fire Hazard

The fire hazard previously referred to is pronounced. The larger of the Lehigh Valley elevators is the only one in the Port that can be considered fireproof. Because of the small capacities of the individual elevators a single fire could not wipe out as much plant as has happened elsewhere; but the destruction of the Erie elevator, for example, would be a serious handicap to the Port.

Facilities at Other Ports

Boston — Boston has an elevator capacity of about 1,500,000 bu., the facilities being owned by the Boston & Albany and Boston & Maine Railroads. By means of conveyor galleries grain is carried along the side of some of the piers and loaded into vessels at their berths. Until 1915 grain was carried from Boston only as part cargo in berth vessels, but in the last five years full cargoes have been exported.

Philadelphia — Philadelphia has two elevators built within the last five years. One has a storage capacity of 2,000,000 bu., the other of 1,500,000 bu. The greater part of Philadelphia's export grain is loaded into full-cargo vessels alongside the elevators. The elevators are owned by the railroads.

Baltimore — Baltimore has an export storage capacity of 5,100,000 bu., and construction now in progress will add 1,000,000 bu. In addition to this there is a capacity for local distribution of 555,000 bu. Fully half of the export capacity represents construction in 1915, in part replacing an elevator destroyed by fire. As at Philadelphia, nearly all of the grain is exported in full-cargo lots, ships floating alongside the elevators, which are all railroad-owned.

Baltimore is the natural outlet of the Baltimore & Ohio Railroad for its export grain, and Philadelphia and Baltimore are the natural outlets for the Pennsylvania Railroad. The two roads have developed extensive elevator facilities at these points and now have none at New York. The differential rates these ports enjoy save the roads the necessity of meeting the New York competition with a longer haul over the crowded lines leading to New York.

Newport News — Since the burning of an elevator in 1915 Newport News has had only one elevator, with a storage capacity of about 1,000,000 bu. It is railroad-owned. Grain is exported from Newport News in full cargoes, ships loading alongside the elevator.

Until a few years ago a small amount of grain was exported from Norfolk, but this movement has ceased.

Montreal — Montreal has more and better equipped elevator capacity than any of our ports. Its seven elevators have a combined capacity of 11,320,000 bu. Only two of these are railroad-owned. The two largest, with respective capacities of 4,000,000 and 2,660,000 bu., are operated by the Harbour Commission.

Little grain is exported from Montreal in full cargoes, most of it being handled on liners as supplementary cargo. Originally the transfer between barge and ship was effected by floating grain elevators operated by the Harbour Commission. The same need for a Barge Canal that is now perceived at New York with respect to the Barge Canal became apparent, and the Harbour Commission built stationary elevators on the hinterland back of general-cargo piers, whence the grain could be brought to the piers and loaded upon the ships at their berths by means of the conveying galleries previously mentioned. This arrangement has greatly stimulated the movement of grain through the port. The Harbour Commission still has seventeen floating elevators available, but relies mainly on the land elevators.

New Orleans and *Galveston* have facilities comparable with those of some of their Atlantic competitors, and it is evident that in proportion to the general traffic of the different ports a number of them are better equipped to handle grain than New York is.

Transportation from Middle West to Seaboard

When we consider the facilities for moving the grain from the Middle-West elevators to tidewater, New York has an advantage over most of the other ports, but this advantage is not so pronounced as to warrant indifference to the efforts of the other ports to obtain the grain traffic.

Distance is hardly a factor in determining the relative advantages of the different ports. Arcs of circles passing through New York with either Chicago, Duluth or Fort William as centers would not pass far from any of the principal Atlantic or Gulf grain ports. Baltimore, Philadelphia, Montreal and Mobile have some advantage over New York with respect to Chicago (measured by the shortest rail line); Montreal, Mobile and New Orleans have slight advantages via Duluth, while Montreal is nearest to Fort William. The differences in distances are not great, however, nor are the remaining ports at a great disadvantage in this respect. New York's advantage lies rather in its choice of rail and water-rail routes, and in its opportunity, shared by Montreal only, for an all-water movement. Some of the ports rely on two or three all-rail routes and possibly two or three combination rail-and-water lines. New York has seven or more all-rail routes, five rail routes from Buffalo, and its Barge Canal.

At one time a considerable amount of grain was moved by boat down the Mississippi River. This movement has been entirely discontinued, and the Gulf ports depend wholly on their rail connections. Philadelphia and Baltimore are able to utilize the advantages of the Great Lakes, transfer from steamer to car being made at Buffalo, Erie or some point in Ohio. Boston is in about the same position, with a longer rail haul; Boston also gets some of Montreal's winter grain. Portland, like St. John and Halifax, receives virtually all of its grain by rail from Montreal, and only in winter when the lower St. Lawrence is closed by ice.

ROUTES TO MONTREAL

Like New York, Montreal has a decided advantage over the other Atlantic ports in that it can receive its grain either by rail or by water. As in the case of New York, the grain that comes from the interior by water arrives chiefly in barges, because the inland waterways leading to the ports are in part of insufficient depth for large ships. A few ships of small draft make the entire trip from Great Lakes points to Montreal; in general, however, grain for Montreal moved in ships from Chicago, Duluth or Fort William is transferred to barges at Port Colbourne on Lake Erie, at the head of the Welland Canal, just as grain for New York is transferred at Buffalo.

TRANSFER AT BUFFALO

Buffalo is the point of transfer for practically all New York grain except that shipped wholly by rail, whether the transfer is to cars or to barges. Buffalo is by far the most important of the transshipment points for "ex-lake" grain, receiving on the average nearly half as much grain as passes through Chicago and more than twice as much as passes through Duluth. Only a brief free-storage period (10 days) is allowed at Buffalo, however, so that the grain must be promptly transferred and reshipped.

The railroads leading direct from Buffalo to New York are the ones which own such facilities as exist at the Port of New York, and are in the main able to take care of the present flow. The Barge Canal has up to the present time had no facilities at the New York end, depending only on an elevator ostensibly operated as a public elevator, but owned by a competing railroad. This situation is being met by the construction of the Gowanus Bay elevator.

Ocean Transportation

There are two kinds of ocean transportation for grain. Grain may be exported as part cargo on liners carrying general freight, or as the entire cargo of tramp vessels. Baltimore and Philadelphia specialize in the tramp service. Montreal has no considerable tramp service and exports most of her grain by liners. New York and Boston, relying chiefly on the liner service until a few years ago, are now shipping a considerable amount in full cargoes.

Various considerations enter into the relative desirability of the two classes of service. Baltimore and Philadelphia, with a comparatively small number of liners, could naturally not get the large amount of export trade they do get except by making it attractive to tramp ships. New York, with the cream of the liner service, will always be able to ship a large amount of grain by liners, some of it to points not reached by liners from other American ports. The great increase in her total grain exports since she began to ship full cargoes is evidence enough, however, that the development of the full-cargo business has not been made at the expense of the liner traffic, and should be pushed to the utmost.

Full Cargoes

In 1911 four full cargoes of grain were shipped from New York. In 1912 and 1913 there were twenty-four and twenty respectively. In 1914 the slip alongside the Erie elevator was dredged to permit ships to dock there, and that year seventy-four full cargoes were shipped. In 1916, when the war was making unusual demands upon our ability to supply grain, 410 full cargoes left this port.

Rates and Charges

Rates and incidental charges have a vital bearing on the routing of grain. At the same time they are most difficult to regulate or even to predict. Ocean rates fluctuated 60 per cent over night during the war, although they are more stable now.

In the matter of all-rail service, New York, Boston and Portland labor under the handicap of the unfair differential enjoyed by Philadelphia, Baltimore and Newport News. In 1913 Baltimore's advantage in this respect was about 0.65¢ per bushel. New Orleans, on the other hand, pays a slightly higher rate than New York.

Because of the disturbing effect on rates and charges caused by the war, probably the best conception of the relative conditions at the different ports can be obtained if we go back to 1913. Changes in rates since then have been nearly horizontal, and the basic relations have apparently remained about the same.

Comparing New York's all-rail service with her lake-and-rail and lake-and-canal service, we find that while the all-rail transportation rate was at that time considerably higher, this was virtually offset by the additional charges in the combination service — elevating the grain at the Middle-West terminal elevator; insurance, which was absorbed in the all-rail rate; elevating at Buffalo, and in the case of grain moved via the Barge Canal, insurance in transit and trimming of the barge. These items amounted collectively to 0.8¢ per bushel in the case of lake-and-rail service and 2.8¢ in the case of the lake-and-canal service, in a total of approximately 8¢ per bushel from Chicago to New York.

Floating-elevator service was charged for at the Port of New York at the rate of ⅞¢ per bushel for elevating the grain, to which was added ⅛¢ per bushel for transporting the elevator. Trimming the ship or barge, working the grain, handling small lots and overtime work involved additional charges. This charge was subsequently only partly escaped when loading of the ship direct from the elevator became possible, inasmuch as the railroads, while transferring grain to barges and delivering it alongside vessels free, make a charge of ½¢ per bushel, known as a "fobbing" charge, for transferring it to ships.

On the ocean the grain is subject to a transportation charge proper, and insurance. The former is based on the freight rate in the case of a liner, and on the charter rate of the vessel in the case of a tramp ship. In general both the transportation charge and the insurance were higher in 1913 on tramp ships than on liners, at both New York and Montreal. Table 14 gives a comparison of the rates to London from New York and Montreal by liner and by tramp, for a period of seven months. It shows among other things the wide fluctuations from month to month. Insurance is calculated on wheat at $1 per bushel.

Table 14 — Comparison of Ocean Charges to London on Wheat During Seven Months of 1913, in Cents per Bushel

Month	Item	New York Liner	New York Tramp	Montreal Liner	Montreal Tramp
May	Rate	7.00	8.25	8.625	.....
	Insurance	*.19	.30	.20	.....
	Total	7.19	8.55	8.825	.....
June	Rate	5.50	......	*8.25	7.50
	Insurance	*.19	.30	.20	†.31
	Total	5.69	......	8.45	7.81
July	Rate	4.875	*7.69	*8.625	*8.625
	Insurance	*.19	.30	.20	†.31
	Total	5.065	7.99	8.825	8.935
August	Rate	4.625	*8.15	*7.125	*8.625
	Insurance	*.19	.30	.20	†.31
	Total	4.815	8.45	7.375	8.985
September	Rate	4.50	7.50	*6.75	*8.875
	Insurance	*.19	.30	.20	†.31
	Total	4.69	7.80	6.95	9.185
October	Rate	4.625	*6.56	*7.125	.....
	Insurance	*.19	.325	.238	.....
	Total	4.815	6.885	7.363	.....
November	Rate	3.125	*5.81	*7.50	.....
	Insurance	*.19	.35	*.375	.....
	Total	3.315	6.16	7.875	.....

Insurance calculated on wheat at $1 per bushel.
*Average.
†Approximate.

TABLE 15 — COMPARISON OF APPROXIMATE TOTAL TRANSPORTATION CHARGES ON WHEAT FROM CHICAGO TO LONDON BY VARIOUS ROUTES, DURING SEVEN MONTHS OF 1913, IN CENTS PER BUSHEL

Route	May	June	July	August	September	October	November
Via New York							
All rail and liner	15.49	13.90	13.36	13.11	12.99	13.11	11.61
Lake, rail and liner	15.30	13.80	13.17	12.92	12.80	12.92	11.42
Lake, canal and liner	15.68	14.18	13.55	13.30	13.18	13.30	11.80
All rail and tramp	16.85	.....	16.29	16.75	16.10	15.28	14.46
Lake, rail and tramp	16.66	.....	16.10	16.56	15.91	15.09	14.27
Lake, canal and tramp	17.04	.....	16.48	16.94	16.29	15.47	14.65
Via Montreal							
Liner	15.00	14.42	15.00	13.55	13.12	13.54	14.05
Tramp	.....	13.98	15.11	15.11	15.36	.....	.....
Via Baltimore							
Tramp	16.25	.....	15.69	16.15	15.50	15.58	13.86

Table 15 shows approximately the comparative total transportation charges on wheat from Chicago to London via New York, Montreal and Baltimore. It shows that the advantage of one port over another in the matter of charges was not great enough in 1913 to give any one of these ports any decided advantage over the others. The same was true of the other grain ports, and is true of all of them at the present time.

Table 15 also appears to show lake-and-canal traffic at a disadvantage at New York as compared with either lake-and-rail or all-rail traffic. It should be borne in mind, however, that these rates are based on 1913 conditions, before the Barge Canal was opened for operation. The average Erie Canal rate was then 4.38¢ per bushel. It is reasonable to believe that the rate on the Barge Canal can be reduced at least 2¢. Subtracting 2¢ from each of the canal figures in Table 15 would give the canal route a decided advantage over every other route whether via New York or via one of the other ports.

Needs of the Port of New York

Other conditions have a bearing on the distribution of grain exports through so many ports, but they do not alter the fact that New York gets as large a share as it does less because of its efforts to get it than because of its natural advantages; and that it is likely to get a smaller percentage in the future unless it bestirs itself.

Full Cargoes — There is reason to believe that New York's liners are taking about all the grain they can handle. An increase in the number of liners might result in a corresponding increase in the grain they carried, but, on the other hand, some of the largest and newest vessels carry no grain. Likewise liner service established at other American ports will attract grain. Certainly it is unsafe for New York to continue to feel that its grain trade is automatically taken care of by its extensive liner service. Its main opportunity of the future is in the tramp service, and it behooves the Port to solicit it in a more definite way.

There is another reason why New York should favor this trade in the development of its facilities. Loading direct from elevator to ship, without the intermediate floating service, is certainly the cheapest means of transfer. It is feasible at Montreal, where there is a comparatively small amount of developed waterfront and a comparatively small number of berths, to serve the principal general-cargo piers by means of conveyor galleries. It would not be feasible in New York to serve any considerable percentage of them, scattered as they are and will always be over many miles of waterfront. The grain facilities should be concentrated at a few points where grain ships can load.

Large Elevator for Joint Use — While there is ample room for improvement of the individual facilities at the railroads, the Port will derive far greater benefit by the construction of a large elevator or series of elevators that could be used by all of the railroads from the West and by the Barge Canal as well. They should be located on deep water, and the natural location is at or near one of the southerly termini of the proposed exterior belt line. They should be fireproof and be equipped with all of the facilities of a modern terminal elevator.

Barge Canal Elevator on Gowanus Bay — An elevator, also fireproof, is being built at the Gowanus Bay terminal of the Barge Canal for receiving and storing canal-borne grain and for delivering it to barges and ships. From it deliveries can be made to cars for Brooklyn, Long Island and New England via the proposed Brooklyn marginal railroad system.

Elevator at Piermont — An elevator should be built at Piermont, accessible to canal barges and to the New Jersey railroads via the exterior belt line, for local distribution.

Local Distribution — Existing railroad grain-handling facilities, relieved of the export grain, will probably answer for the local distribution of grain for some time to come. Ultimately they will naturally be replaced by more efficient elevators better placed.

New York Barge Canal — The New York Barge Canal is a natural medium for transporting grain. It needs (1) more barges and towing equipment of a size and capacity commensurate with the possibilities of the canal as recently enlarged, (2) facilities at the Port of New York such as have been recommended for taking as much grain as may come through the canal and (3) administration of the canal in a manner favorable to the development of its traffic. Given these things, the canal should become the principal and cheapest medium for bringing grain to New York and should more than offset the advantage derived by Philadelphia and Baltimore through their differentials, and by Montreal through her all-water route navigable to small ships.

Terminal Charges — The incidental handling charges at the Port should be adjusted. It is unfair to deliver grain free from elevator to barge and tow the barge to any point within the lighterage limits of the harbor and yet charge half a cent per bushel for merely delivering the grain direct from the elevator to the ship. This fobbing charge should be reduced to just enough to yield the railroads a fair return on the improvements necessary to make such delivery possible.

CHAPTER 30

Handling of Ice

Ice is used in large quantities at the Port of New York, and the handling of it is one of the lesser problems of the Port. A decade ago, when the New York side of the Port depended largely on hudson River ice and the owners of independent ice houses along the river were experiencing great difficulty in obtaining facilities for unloading the ice from the barges in which it arrived, the problem was more important than at present. Now the use of manufactured ice has grown to large proportions, and the producers of the lesser amount of Hudson River ice being cut do not complain of the obstacles in the way of unloading it. The Commission does not feel it necessary to recommend any material change in the facilities or methods of the present time.

Of the two kinds of ice, natural ice for the Port District is harvested along the Hudson River and floated down the Hudson River in barges, or is cut from the mountain lakes of New Jersey and northeastern Pennsylvania and brought in by rail, while so-called artificial or hygeia ice is made at a large number of plants in the district — both plants that manufacture ice solely and those that produce it as a byproduct.

According to a report made to the New York Legislature last year by Hon. B. B. Odell, State ice comptroller during the war, 1,246,055 tons of natural ice and 1,817,800 tons of manufactured ice, making a total of 3,063,855 tons, were sold in New York City in 1918. Figures for the New Jersey ice are not available, nor are those for the relative proportions of natural and manufactured ice. Figures furnished by one of the large ice companies for the years 1911–1917 show an average of about 1,500,000 tons of natural ice shipped annually from the Hudson River to the New York market. During the open winter of 1918–1919 no ice was harvested in the Hudson River, and the supply in the ice houses was at a low ebb at the beginning of the 1919 season. New York did not suffer an ice famine in consequence of this, and it is probable that the deficiency was made up by the artificial plants. It is the Commission's belief, therefore, that half of the ice consumed at the Port is artificial and that the proportion of artificial ice is increasing.

NATURAL ICE

There are about one hundred ice houses along the Hudson River from Kingston to north of Albany. All but twenty of these are controlled by two large companies. Their houses have an aggregate capacity of approximately 2,000,000 tons. The twenty independent houses have a capacity of about 450,000 tons. One of the two large companies has an additional capacity of about 200,000 tons in eight houses on lakes and ponds north of New York City.

The ice is brought down the river in barges and unloaded at "bridges" on wharves. In 1918 there were eleven bridges in operation along the Hudson River in Manhattan, fourteen along the East River in Manhattan, nine along the Harlem River and eleven in Brooklyn, Long Island City and Flushing — a total of forty-five. All but thirteen were controlled by the two largest companies. Control of the bridges was thus about proportional to the capacities of the respective companies' ice houses, and the Commission finds no reason to believe that the natural-ice industry is suffering for want of ice bridges accessible to the independent producers.

There are five railroad ice depots in the Bronx, two in Brooklyn, four on Staten Island and one in Yonkers. The Bronx and Yonkers depots are supplied from the north, the Brooklyn and Staten Island depots from New Jersey.

Two New Jersey companies control about 75 per cent of the natural ice business on the New Jersey side of the Port District. These companies together have about thirty ice houses on the New Jersey and Pennsylvania lakes, with a capacity of about 1,500,000 tons. The Commission has no precise figures as to the amount brought to the Port. It is shipped in by rail in either ice cars or ordinary box cars.

The business of harvesting and marketing natural ice is somewhat precarious. The amount that can be harvested depends on weather conditions. Winter before last none was harvested. Usually the ice-cutting season is brief, and it is difficult to get labor for it. To safeguard against open winters it is desirable to stock ice houses to capacity when this can be done, consequently some ice is usually held over through the entire year. Much of it melts. The ice houses are usually of frame construction, located at points where fire protection is inadequate. Fire destroys many ice houses and their contents.

In the marketing of the ice there are additional risks and losses. The barges are not ideal for carrying ice, and much of the ice melts coming down the river. At the ice bridges more is lost. It has been estimated that from the time the ice is cut until it is weighed at the ice bridges 40 per cent is lost in meltage.

It is estimated that Hudson River ice was costing from $1.25 to $1.50 per ton in 1918 up to and including delivery to the dealers' trucks. The individual items were about as follows: Harvesting and packing, 40 to 50 cents; packing aboard barges, 25 to 30 cents; towing to New York, 35 to 40 cents; placing on trucks, 25 to 30 cents.

Costs of handling ice have mounted rapidly in recent years, especially labor costs, which constitute 70 per cent of the total cost for natural ice, as against 15 per cent for artificial ice. Barge rentals have in some instances increased more than 200 per cent, and towing charges have likewise greatly increased.

There is plenty of suitable water available within easy reach to provide the Port with as much natural ice as it could conceivably require, provided there is sufficient cold weather to produce a good crop. It has been calculated that Greenwood Lake alone, frozen to a depth of one foot, would produce 6,100,000 tons, or more than twice the present capacity of the Hudson River houses.

MANUFACTURED ICE

There were in 1918 eighty-four plants in New York City and twenty-two in New Jersey within the Port District for manufacturing ice — artificial or hygeia ice, as it is commonly called. The plants were distributed approximately according to population. Manhattan and Brooklyn leading on the New York side with twenty-seven and thirty-one respectively, and Newark on the New Jersey side with eight. The listed capacities of the eighty-four New York plants totalled 13,180 tons daily, and of the New Jersey plants, 1,967 tons daily. There are also twenty-two plants in the metropolitan district that make ice as a byproduct. They have a combined daily capacity of 3,155 tons. More than half of the capacity of the hygeia ice plants in Manhattan, and a fifth of that in Brooklyn, is controlled by one of the large producers of Hudson River ice.

Hygeia ice plants can be located near the markets, and the losses in transit are largely avoided. They can operate the year around, avoiding the still greater losses of large quantities stored in ice houses. They can furthermore be operated according to the demand. The fact that hygeia ice can be produced as a byproduct of plants and used primarily for other purposes is another advantage the hygeia ice enjoys.

It takes about 300 lb. of coal and 1/5 lb. of ammonia to produce a ton of hygeia ice. It costs about $1.50 a ton in an electrically operated plant and a little more in a steam plant. Labor as previously stated constitutes only 15 per cent of the entire cost.

In consequence of the advantages mentioned, the production of natural ice is decreasing while that of manufactured ice is increasing. Hudson River ice houses destroyed by fire are not being replaced, and it seems likely that the trend will remain the same until the manufactured ice far predominates.

MARKETING OF ICE

The marketing of ice is about the same whether the ice is manufactured or natural. The consumer gets his ice either from the large producer direct or from the middlemen. The middlemen consist of large dealers who supply hotels, butchers and other large consumers, and small "cellar" dealers, of which there are about 1,200 in Manhattan alone. The retailers large and small go to the ice bridges, depots or hygeia plants for their ice and truck it away themselves. Thence it is peddled from house to house in the manner familiar to all. Further losses take place in the marketing, as much as 12 per cent of the ice put on a wagon on a family route being sometimes lost from meltage. It is not the function of this Commission to propose a remedy for this condition, if there be a remedy possible.

CONCLUSION

The main concern of the Commission in the handling of ice is in the provision of any needed waterfront facilities. With the diminishing of the Hudson River ice trade and of the dependence of New York on it, the need for those waterfront facilities has diminished correspondingly. The manufacture of hygeia ice at inland points is hardly within the scope of the Commission. The same is true of the marketing of either natural or hygeia ice. Therefore the Commission makes no recommendation regarding the handling of ice.

CHAPTER 31

Electric Power Plants and Power Supply

The large electric power plants within the Port District are the concern of the Commission for two reasons: (1) Because electricity will be an important factor in the ultimate plan of the Commission, making it desirable that full information be at hand relative to power supply available continuously or in emergencies, and (2) because the plants require a large amount of fuel, the handling of which is costly. As to the first reason, the Commission has found that while a number of plants are available for emergency service, so that the automatic-electric system, for example, would not be wholly incapacitated by the failure of its power, still there is practically no surplus power available for continued use. The various public utilities require all the power they generate and are frequently adding to their plant. As to the second reason, the Commission is definitely of the opinion that the prevailing method of floating coal in barges to plants scattered at various points in the harbor is wasteful, and could well be done away with by locating the plants in New Jersey and transmitting the power electrically into New York. This second phase of the subject is treated in Chapter 28.

Existing Plants and Their Output

There are nine principal public-service companies generating electricity in the Port District — the New York Edison Company, the Interborough Rapid Transit Company, the Hudson & Manhattan Railroad Company, the New York Central Railroad Company, the Pennsylvania Tunnel & Terminal Company, the Brooklyn Rapid Transit Company, the Brooklyn Edison Illuminating Company, the Richmond Light & Railway Company and the Public Service Corporation of New Jersey. Collectively they have thirty plants with a capacity of 1,382,445 kw., including additional units that were being installed when these data were collected, and a present surplus capacity of about 105,000 kw. The accompanying table summarizes them.

PUBLIC UTILITY ELECTRIC POWER PLANTS WITHIN PORT DISTRICT

Company	Number of plants	Present capacity, kilowatts	Surplus capacity, kilowatts
New York Edison	5	512,745	100,000
Interborough	2	375,000	....
Hudson & Manhattan	1	24,000	....
New York Central	2	60,000	....
Pennsylvania	6	66,500	5,000
Brooklyn Rapid Transit	3	139,100	....
Brooklyn Edison	2	91,700	....
Richmond Light & Railway	1	22,800	....
Public Service of New Jersey	8	90,600	....
Total	30	1,382,445	105,000

NEW YORK EDISON COMPANY

The New York Edison Company, with its subsidiary companies — the United Electric Light & Power Company, the New York & Queens Electric Light & Power Company and the Westchester Lighting Company — is the principal producer of electric power at the Port, and the only one which at the present time has any appreciable surplus capacity. Its principal plant is on the East River and First Avenue, Manhattan, between Thirty-eighth and Fortieth Streets. Here are Waterside Stations 1 and 2, which, including new units installed or soon to be installed, have a combined capacity of 287,000 kw. It is these stations, also, that have the surplus capacity.

There is a large plant of the United Electric Light & Power Company in upper Manhattan at 201st Street and the Harlem River which has a capacity of 105,000 kw., and another at 216th Street and Ninth Avenue which is leased from the Third Avenue Railway and has a capacity of 32,000 kw. The remaining capacity is made up by plants for the New York & Queens Electric Light & Power Company in Astoria and the Westchester Lighting Company in Yonkers.

The Edison Company and its subsidiaries have numerous substations in Manhattan, the Bronx and Queens and cover virtually all parts of these boroughs, as well as lower Westchester County. In Manhattan the Company furnishes both direct and alternating current; in the remaining sections the affiliated companies supply alternating current.

Emergency connections with the Interborough Rapid Transit, the Brooklyn Rapid Transit and the Brooklyn Edison companies are maintained so that the service of none of these companies is likely to be crippled by a breakdown of its own power units.

In 1904 the New York Edison Company had a total capacity of 52,100 kw.; in 1911, about 200,000 kw. Additions now under way or projected are expected to bring the total capacity up to 515,800 kw. in 1922 or 1923, but it is estimated that the load will overtake the maximum capacity in 1929. It is evident that the Edison Company cannot be expected to supply other than emergency service for any large installations recommended by the Commission requiring electric power.

INTERBOROUGH AND HUDSON & MANHATTAN

The Interborough Rapid Transit Company has two generating stations — one at Seventy-fourth and Exterior Streets on the East River, the other at Fifty-ninth Street and Eleventh Avenue on the Hudson River. The former has a generating capacity of 180,000 kw., the latter one of 195,000 kw., both figures including new installations being made some months ago when this phase of the Commission's investigation was made. The plants generate 11,000-volt, 25-cycle, three-phase current. They have no surplus power.

The one power plant of the Hudson & Manhattan Railroad Company is on Washington Street, Jersey

City, between Bay and First Streets. It has a capacity of 24,000 kw. with provision for additional units, and a small surplus capacity for the company's own use. The plant generates 11,000-volt, 25-cycle alternating current, which is converted at substations to 625-volt direct current. There are three substations, at Hudson Terminal, at Christopher and Greenwich Streets, New York, and at the Jersey City plant.

NEW YORK CENTRAL AND PENNSYLVANIA RAILROADS

The New York Central Railroad has two power plants — the Port Morris, at 143rd Street and Long Island Sound, and the Yonkers, on the Hudson River at Glenwood, a mile north of the business center of Yonkers. The former has a capacity of 40,000 kw., the latter one of 20,000, both generating 11,000-volt, three-phase, 25-cycle alternating current, which is transformed to direct current. The plant has no surplus capacity. There are nine substations from Fifty-ninth Street, Manhattan, to Ossining and White Plains.

Power for the operation of the Pennsylvania Railroad between New York and Newark, and for the operation of the electric line of the Long Island Railroad, is generated at the main plant of the Pennsylvania, Fourth and Front Streets, Long Island City. The plant has a capacity of 63,000 kw. at 11,000 volts, and has a surplus capacity of 5,000 kw. There are substations, which convert the power to 650-volt direct current, at the main plant, at the Pennsylvania Station at Thirty-third Street, Manhattan, at the west portal of the Hudson River tunnel and at Manhattan Transfer in New Jersey.

Small generating plants for the company's local needs are located at the Pennsylvania Station, at the Cortlandt and Desbrosses Street ferries, at Greenville yard and at Harsimus Cove, Jersey City.

BROOKLYN AND RICHMOND COMPANIES

The Brooklyn Rapid Transit Company has three generating stations — the Central at Third Avenue and Second Street, the Ninth Street at Ninth and Smith Streets and the Williamsburgh at Kent Avenue and Rush Street. The Central Station has a capacity of 5,400 kw. of 5,500-volt direct current and 16,200 kw. of 6,500-volt alternating current. The Williamsburgh Station can produce 112,500 kw. of 6,600-volt alternating current. The Ninth Street Station is rated at 5,000 kw. of 11,000-volt alternating current. There is no surplus capacity. There are twenty-four substations, which convert the power to 575-volt direct current.

The Edison Electric Illuminating Company of Brooklyn has two power stations, both on the East River, at Sixty-sixth and Gold Streets respectively. The former plant has a capacity of 11,700 kw., the latter one of 80,000 kw., both generating 6,600-volt, 25-cycle, three-phase alternating current. The company has nineteen transformer stations for converting alternating current into direct current.

The one power house of the Richmond Light & Railway Company supplies all electric light and power for Staten Island and all energy for the street railways. It has a capacity of 22,800 kw., including additions being made some time ago when the information was obtained regarding the plant. Both direct and alternating current are generated. There is no surplus power.

PUBLIC SERVICE ELECTRIC CORPORATION

The Public Service Electric Corporation has electric power plants and substations all the way from New York to Philadelphia. In the district embraced by this investigation are eight generating stations and about forty-five substations. The former are located at Edgewater, Hoboken, Jersey City (Marion Station), Secaucus, Newark (two, Essex Station and Newark Station), Perth Amboy and Metuchen. The Marion and Essex stations each have more than a third of the Company's total capacity for the Port District. These two stations and those at Perth Amboy and Metuchen generate mainly 13,200-volt alternating current. At the others 550-volt direct current as well as some alternating current of lower voltage than that at the Marion and Essex plants is produced.

None of these stations has any surplus capacity. The smaller ones, such as Edgewater, Hoboken, Secaucus and Metuchen, are used mainly as standby stations; their steam consumption is high and they cannot be operated continuously because of their age.

The growth of the Public Service Corporation throughout the State of New Jersey is indicated by the following figures for kilowatt-hours sold: In the year 1905, 48,894,308; in 1911, 103,144,595; in 1917, 371,509,459.

CHAPTER 32

Water Supply for the Port

One of the necessities of any community is a supply of pure water large enough to meet the future growth of the community. The necessity looms large at the fast-growing group of cities and towns constituting the Port of New York, and it behooves us to know whether their future needs can be taken care of. The Commission has made a thorough investigation of this subject and is satisfied that there need be no fears on this score. New York City with its new Catskill supply makes provision for the present, and the works now under construction to enlarge that supply will make provision until 1940. In the course of time New York may have to go to the Adirondacks, but plenty of water can be had there. New Jersey is still more fortunately situated in this respect. It is estimated that the sources of water immediately adjacent to the Port would provide for a population of more than 12,000,000, while the sources throughout the State would take care of 50,000,000 inhabitants.

There are wide differences in the per-capita consumption of water in American cities. In some cities, where the domestic service is metered and there is a comparatively small amount of water used for railroad, manufacturing or other broad-scale purposes, the consumption may run as low as 30 gal. per capita per day. At other cities where there is less incentive to individual economy or where there are large railroad or industrial consumers, it may run as high as 300 gal. per capita. Jersey City, mainly because of its railroad yards, consumes more water than Newark, with its larger population.

Figures assembled by the Commission indicate that the average daily consumption of water in 1917 within boundary lines approximating those conceived by the Commission as defining the Port was 797,358,660 gal. The estimated population within the same boundaries was about 7,900,000. Therefore the average daily consumption per capita was 100 gal. in round numbers.

Water for the communities of the Port comes in the main from the following sources: From Croton River in Westchester and Putnam Counties, New York, and the headwaters of Esopus Creek in the vicinity of the Catskill Mountains for Manhattan and other parts of New York City; from ground wells for parts of Brooklyn and Queens; from local watercourses and wells for Yonkers, Mount Vernon and New Rochelle; from tributaries of the Passaic River for Newark and Jersey City; from the Passaic River itself for Paterson, Passaic, Bayonne and other New Jersey cities; from the Hackensack River for Hoboken, Weehawken and numerous other communities in the northeastern part of New Jersey; and from local surface water and wells for Elizabeth, Perth Amboy, New Brunswick and the communities between those cities. The water from the Passaic and Hackensack Rivers is of course drawn at points above tidewater pollution, and is filtered before distribution.

New York City's Water Supply

Our first record of any attempt to provide New York with waterworks was in 1774, when the city had a population of about 22,000. Christopher Colles, an English engineer, built a system consisting of a reservoir on the east side of Broadway between Pearl and White Streets; a large well sunk near a fresh-water pond occupying the space where now stand the Tombs and surrounding buildings; a steam engine for pumping the water from the well to the reservoir, and a system of distributing pipes consisting of hollow logs. The works were put into operation in 1776, but soon abandoned because of the disruption caused by the Revolution.

In 1799 the Manhattan Water Company sank a large well at Reade and Center Streets and began to pump water therefrom into a 550,000-gal. reservoir it built on Chambers Street between Broadway and Center Street, whence the water was distributed through log pipes. The water is said to have been neither ample nor of good quality, but no further advance was made for thirty-five years.

CROTON WATER SUPPLY

In 1834 the Legislature took steps to provide the city with a supply that with later additions met the needs of the growing city until the beginning of the twentieth century. The supply was taken from the Croton River, which empties into the Hudson from the east about 35 miles above its mouth. The works, which were built in the years 1837–1842, consisted of:

1. A storage reservoir of 600,000,000 gal. capacity, created by a dam across the Croton River about five miles above its mouth.
2. An aqueduct from there to New York designed to deliver about 43,000,000 gal. in 24 hours.
3. A receiving reservoir of 180,000,000 gal. capacity on Manhattan Island, in what is now Central Park.
4. A distributing reservoir of 24,000,000 gal. capacity on Murray Hill, on the site of the present public library.
5. A pipe line of three 36-in. mains between the two reservoirs on Manhattan Island, and smaller mains for the further distribution of the water.

This system, known as the old Croton waterworks, was put into operation July 4, 1842. It included the stone arch aqueduct across the Harlem River at High Bridge, which, having outlived its necessity, is now to be removed or remodeled, being an obstruction to navigation.

In 1886 it had become necessary to expand the system, and from then until as late as 1911 new impounding and distributing reservoirs, aqueducts and the like were being built. The majority of them derived their water from the Croton watershed, but some was taken from the Bronx and Byram Rivers, which flow south into the East River and Long Island Sound respectively. The most important of these additional works were the new Croton aqueduct, which was ready in 1891 to relieve the old aqueduct, and which passes under instead of over the Harlem River; and the new Croton dam, which, put into service in 1905, intercepted the river three miles below the old dam and raised the water thirty feet above the old dam, completely submerging it and giving a reservoir capacity of 33,815,000,000 gal. An important work within the limits of New York City was the Jerome Park reservoir, built in the Bronx not far from the north boundary line in 1895–1905. The Murray Hill reservoir was removed.

CATSKILL WATER SUPPLY

Despite the continual expansion of the Croton waterworks, it became apparent at the beginning of the present century that an entirely new source would have to be found. In 1905, the same year the new Croton dam was put into service, an act of the Legislature was passed creating a Board of Water Supply of three members. Careful study of the situation resulted in the selection of the Esopus and other watersheds in the vicinity of the Catskill Mountains on the west side of the Hudson River. Construction was started shortly afterward, and the new system, representing an expenditure of nearly $200,000,000, was put into service in 1917. Water for this system is impounded in a large lake, the Ashokan reservoir, west of Kingston, and carried by gravity to New York in a large conduit which passes under the Hudson River at Storm King. While the Croton works served only Manhattan and the Bronx, Catskill water is distributed to all five boroughs of the city.

Among the elements which make this one of the greatest waterworks projects in the world may be mentioned the Ashokan reservoir, a lake some 12 miles long and one to three miles wide, created by the building of a high masonry dam and a number of earthen dikes; the 92-mile aqueduct, which is mainly a horseshoe-shaped conduit 17½ ft. wide and 17 ft. high on the inside; the Storm King siphon, a tunnel in deep rock under the Hudson River several hundred feet below its bed; a number of other pressure tunnels under watercourses; the equalizing reservoir created at Valhalla, three miles north of White Plains, by the construction of a high masonry dam across the Bronx River valley; the Hill View Reservoir, an equalizing reservoir on a hilltop in Yonkers near the north boundary of the City of New York; the so-called city tunnel, a circular tube driven through solid rock from 180 to 300 ft. below the surface of the ground, running nearly the length of Manhattan and under the East River to Brooklyn; the Narrows siphon, a 36-in. pipe laid on the bed of the Narrows from Brooklyn to Staten Island at a depth of approximately 65 ft., and the Silver Lake distributing reservoir in Staten Island.

The Ashokan reservoir is on Esopus Creek, a tributary of the Hudson, in the northern part of Ulster County. It has a storage capacity of 128,000,000,000 gal., and, with the Croton supply, can furnish an average, it is estimated, of about 592,500,000 gal. per day. This, it may be noted, is only enough for 100 gal. per capita for the present population of the five boroughs of New York. Brooklyn and Queens, however, are supplied to a large extent from other sources, as will be set forth. Furthermore, the Esopus watershed is only one of four ultimately to be included in the system, the other three being those of Rondout, Catskill and Schoharie Creeks; and work is under way for the inclusion of the Schoharie.

Schoharie Creek rises in Greene County just north of the Esopus watershed, and flows north, at present, into the Mohawk River. By means of a dam across the creek at Gilboa and an 18-mile tunnel, known as the Shandaken tunnel, under construction leading to the Esopus watershed, the water will be diverted into the Ashokan reservoir. This, with the other additions forming part of the present program, will, it is expected, add a minimum daily yield of 500,000,000 gallons.

The aqueduct has a discharging capacity of about 500,000,000 gal. per day. The Hill View Reservoir has a capacity of 900,000,000 gal., while that at Silver Lake has a capacity of 453,000,000 gallons.

WELLS IN BROOKLYN

Before Brooklyn became part of New York the city was supplied in part from streams on Long Island emptying into the Atlantic Ocean, and in part from a large number of wells and two infiltration galleries. Brooklyn continued to depend on these sources until the Catskill system was made available in 1917.

The first waterworks for Brooklyn were constructed in 1858–1861. A conduit 12 miles long was built from Hempstead Pond to reservoirs at Ridgewood, Brooklyn. The conduit intercepted various streams en route. The watershed gave an average minimum supply of 57,000,000 gal. per day.

In the '70s a reservoir with a capacity of 1,000,000,000 gal. was built on the stream supplying the water at Hempstead. In 1890–1893 a new conduit was built to draw from streams beyond Hempstead Pond as far east as Massapequa. Additional pipe lines and conduits were subsequently laid.

Beginning in 1882, the supply obtained from these conduits was gradually increased by pumping into the supply ponds or directly into the conduits water from wells driven at different points along the conduits. There are twenty-two such pumping stations along the conduits, in addition to which there are three driven-well plants within the borough, at Gravesend, Canarsie and New Lots respectively, from which water is pumped into the distributing system.

The average daily consumption of water in Brooklyn in 1916 was 151,100,000 gal., including 14,600,000 gal. supplied by private companies. About 85 per cent of the supply was ground water, obtained from the driven wells or the two infiltration galleries.

Since April, 1917, Brooklyn has received her supply from the Catskill system, with the exception of a small quantity of water delivered by the Flatbush Waterworks Company. The pumping stations have all been shut down, but are kept in reserve to meet emergencies.

WATER SUPPLY FOR QUEENS

When the numerous communities in Queens County were made part of New York City in 1898, the city took over the following pumping plants: Three pumping stations in Long Island City drawing water, not exceeding 2,000,000 gal. per day, from wells; the Flushing plant, known as the Bayside plant, which drew an average of about 750,000 gal. per day from wells; the College Point plant, known now as the Flushing plant, which drew about 550,000 gal. per day from wells; and the Whitestone plant, which drew less than 150,000 gal. per day. One of the Long Island City plants was put out of commission in 1902 by a boiler explosion. The other five plants were kept in service until Catskill water became available in 1917.

The supply furnished by the city is not yet sufficient for Queens, part of which is still supplied by private water companies that sell direct to the consumers. There are six such private companies, one of which supplies the Long Island Railroad. The average consumption of water in the borough in 1917 was about 43,600,000 gal. per day, of which 21,100,000 gal. were supplied by the private companies.

PRIVATE WATER COMPANIES ON LONG ISLAND

The principal private water companies operating in Long Island are the Citizens Water Supply Company, Flatbush Waterworks Company, Woodhaven Water Supply Company, Queens County Water Company and Jamaica Water Supply Company. In 1917 these companies, with two smaller ones, were furnishing about 38,000,000 gal. per day, or enough to supply 380,000 persons. Since the Catskill water has been available to all boroughs of the city, the quantity of water obtained from the private companies has been much reduced.

The Citizens Water Supply Company, of Newtown, was organized in 1893 to serve the community of that name. It subsequently absorbed two other companies, and in 1908 it contracted to sell water to the City of New York in Queens County. Thereafter it at times supplied as high as 10,000,000 gal. per day. The company has wells in the borough at various points, and others at Valley Stream, Nassau County. It is estimated that the land the company owns could be made to furnish from 50,000,000 to 60,000,000 gal. of water daily.

The Flatbush Waterworks Company was formed in 1881 to serve what was then the town of Flatbush. At present it serves about 100,000 inhabitants of the Flatbush section of Brooklyn. In 1918 it pumped upward of 12,000,000 gal. per day from its one station.

The Woodhaven Water Supply Company was organized in 1888 to supply the township of Jamaica, exclusive of the village of that name. The company gets its water from wells, and has two pumping stations; also two reservoirs, with a combined capacity of about 4,000,000 gal., on the ridge adjacent to Forest Park. The company pumped about 3,300,000 gal. per day in 1918.

The Queens County Water Company was incorporated in 1884 to supply Far Rockaway. The company began with wells at that point, but later developed a larger system of wells at Valley Stream, where it also built a filter plant. The company supplies a number of communities in the Rockaway district, in which it is estimated that the population ranges from 45,000 in winter to 250,000 in summer, and the daily consumption from 2,000,000 to 7,000,000 gal. The company has an estimated possible yield of 40,000,000 gal. per day. It has built two standpipes to regulate the flow, and has reserve wells at Lynbrook.

The Jamaica Water Supply Company was incorporated in 1877 to supply the village of Jamaica. The company has a number of wells from which three pumping stations draw water, and three standpipes at elevated points in the Borough of Queens. In 1918 it was supplying approximately 7,000,000 gal. per day, as compared with estimated resources of from 40,000,000 to 45,000,000 gal. per day.

WATER SUPPLY FOR STATEN ISLAND

Staten Island, until Catskill water became available, was quite inadequately supplied with water, because of the small drainage area of the streams on the island, and because of a stratum of soil which prevented the percolation of much rainfall. The first residents of Staten Island used shallow wells. Later some of the towns and villages were served by three water companies; and Tottenville, at the south end of the island, was supplied by a small plant owned by the City of New York.

One of the private companies, the Crystal Water Company, had two pumping stations, with an aggregate capacity of 6,000,000 gal. per day, and a 4,000,000-gal. reservoir at Silver Lake. The company was acquired by the City of New York about 1909. Another of the companies, the Staten Island Water Supply Company, had four pumping stations with a total capacity of about 14,000,000 gal. per day. The third private plant, which is a very small one belonging to the South Shore Waterworks Company and supplying the former village of New Dorp, was acquired by the city in 1918. The Tottenville plant had three driven wells, from which pumps drew about 150,000 gal. per day.

To increase the island's supply the city in 1912 sank four groups of wells along the Southfield Road, and installed pumps at each group to deliver the water to a central station at Grand City, whence it, with water from other wells at that station, was sent into the distributing system.

The works were becoming inadequate at the time the Catskill system was put into service. Since then the island has been supplied both with Catskill water and with ground water from some of the wells. The average daily consumption in 1917 was 12,400,000 gallons.

Yonkers, Mount Vernon and New Rochelle

By a law passed in 1916 the three cities of Yonkers, Mount Vernon and New Rochelle can draw water from the Catskill aqueduct when necessary, paying for such water the rate charged to the citizens of New York City. Without this opportunity these cities would be near the limit of their water resources.

YONKERS

Yonkers gets its water from the Sprain and Grassy Sprain Brooks, and from the Sawmill River. The city's first waterworks were constructed in 1873–1877.

They took water from the Sprain and Grassy Sprain Brooks, tributaries of the Bronx River, a canal diverting the water from the former into a reservoir in the latter caused by a dam about four miles from the business center of Yonkers. This reservoir, which originally had a storage capacity of about 400,000,000 gal., was enlarged in 1903 to a capacity of about 900,000,000 gal. by the raising of the dam.

A large additional supply was obtained about fifteen years ago by works constructed on the Sawmill River, after an unsuccessful attempt to develop a groundwater supply. This water is filtered and then pumped into the distribution system. An equalizing reservoir, the Fort Field reservoir, was built in 1893–1896 at a point about two miles from the center of the city. It stores about 60,000,000 gal. There are also two water towers.

Yonkers consumed about 10,700,000 gal. in 1918, or somewhat more than 100 gal. per capita. The present sources, exclusive of the Catskill supply, are not sufficient in seasons of drought.

MOUNT VERNON

Mount Vernon was first supplied with water by the Mount Vernon Water Company, which was formed in 1882. The company sank an artesian well and pumped the water into a standpipe. In 1901, after several companies had succeeded the original company, the New York Inter-Urban Water Company was incorporated, taking over the property of the predecessor companies. This company extended its business, and at present it supplies Mamaroneck, Pelham, Rye and certain rural districts as well as the city of Mount Vernon.

From 1886 to 1892 the entire water supply of Mount Vernon was obtained from Hutchinson Creek, which flows into Eastchester Creek. A prior right to that supply, held by the New Rochelle Water Company, made it necessary for the Mount Vernon Company to look elsewhere. An additional supply was found on Tom Payne Creek, in the city of New Rochelle. This water was diverted into that part of Hutchinson Creek from which the Mount Vernon company could draw, at a storage basin of 15,000,000 gal. capacity, known as the Pelham reservoir. A filter plant was built at the reservoir in 1894.

In 1904 the supply was added to by the laying of a pipe line from the Mamaroneck River, where there is a reservoir of 12,000,000 gal. capacity, and a filter plant. The available water resources of the company from Hutchinson Creek, Tom Payne Creek and the Mamaroneck River will now, under average conditions, supply about 10,000,000 gal. per day. To insure an ample supply in seasons of drought or in emergencies, the pipe system of the water company is connected at three points with the pipe system of New York City, and it is also connected with the mains of the Consolidated Water Company of Suburban New York, which supplies certain communities north of Mount Vernon.

The company at present supplies water to a population of about 50,000. All connections are metered, and the average daily consumption is only about 65 gal. per capita.

NEW ROCHELLE

New Rochelle is supplied with water by the New Rochelle Water Company, which also supplies Bronxville, Tuckahoe, Pelham, Pelham Manor, North Pelham and Eastchester. The company was incorporated in 1886.

The water supply is obtained from Hutchinson Creek, Troublesome Brook and two systems of wells. Three reservoirs have been built to impound the water of Hutchinson Creek, and one has been built on Troublesome Brook. One of the well supplies is located on both sides of Hutchinson Creek, at Pelham Heights, about 1¼ miles from the business center of New Rochelle. The other, used only during the summer, is located at Union Corners, about two miles from the center of New Rochelle. The company has three pumping stations and two standpipes.

In 1918 the company was delivering an average of about 3,600,000 gal. daily. It has no water resources in reserve, and the communities it supplies will soon have to draw from the Catskill system in seasons of drought.

New Jersey Cities

With its tributaries the Passaic River, as already pointed out, supplies Newark, Jersey City and a considerable part of the remainder of the New Jersey side of the Port, and its resources are far from exhausted. The Hackensack River supplies Hoboken and a number of smaller communities, while Elizabeth and the towns in general in the southern part of the Port District get their water locally.

NEWARK

Newark's first waterworks were built in 1800 by the Newark Aqueduct Company, the supply being obtained from wells within the city. The city purchased the works in 1860 and drove additional wells from time to time, but in the course of events it became evident that a larger supply must be acquired. The first attempt at an outside source was the construction about 1869 of a station at Belleville to pump from the Passaic River into a reservoir of 44,000,000 gal. capacity.

In 1892 Newark obtained a gravity supply from the drainage area of the Pequannock River, an affluent of the Passaic River to the north of it. The East Jersey Water Company contracted to supply the water, and built a series of reservoirs in the drainage area of the Pequannock, in the vicinity of Newfoundland.

Four of these have a combined storage capacity of about 10,000,000,000 gal. and are located in the hills with their spillway crests from 800 to 1100 ft. above sea level. The Macopin Intake, 21 miles from Newark, is smaller and at a lower elevation. From it pipe lines lead to the city. Seven miles northwest of the city, at Cedar Grove, is a distributing reservoir which stores about 680,000,000 gal. with a high water mark 405 ft. above mean tide. This was built in 1905, and serves as a settling basin and a high-pressure service reservoir. The Belleville reservoir is also retained, for low-pressure service, and there are two other service reservoirs in or near the city.

In 1917 an estimated population of 418,000 consumed a daily average of 45,600,000 gal., or 109 gal. per capita. The per-capita consumption had not varied greatly from this figure for the previous fifteen years. Belleville and part of Elizabeth also derive water from the same supply, however, and during 1918 the consumption was at times as high as 55,000,000 gal. per day. The safe limit of the present sources of water has nearly been reached, and plans have been under consideration for some years for increasing the supply.

An additional storage capacity of from 8,000,000,000 to 10,000,000,000 gal., it is estimated, could be obtained in the Pequannock watershed by the construction of a dam at Charlotteburg, below the Macopin Intake. It is expected, however, that recourse will be had to the Wanaque River, another affluent of the Passaic to the east of the Pequannock River. This river, which is the outlet to Greenwood Lake, on the New York State boundary line, would, it is estimated, supply from 50,000,000 to 120,000,000 gal. daily, which should be sufficient for Newark for the next twenty-five years even if the consumption should continue to increase 10 per cent per annum as it has done during the past twenty-five years.

The works were built by the East Jersey Water Company under a contract which provided that upon their completion in 1900, and the payment by the city of a certain sum of money, they were to become the property of the city. Prior to that time the company could sell some of the water, in excess of Newark's needs, to other consumers. The company actually did sell some of the water to other communities, notably Jersey City; but the plant has as stipulated been turned over to the city of Newark.

JERSEY CITY

The first waterworks for Jersey City were constructed in 1852. Water was pumped from the Passaic River at Belleville into a small reservoir, and thence piped across the Hackensack Meadows to a distributing reservoir of 70,000,000 gal. capacity on Bergen Hill. A second reservoir of equal capacity was built alongside the first on Bergen Hill in 1871–1874, and two standpipes were also built at early dates.

By 1894 the water in the Passaic River at Belleville had become so polluted as to be unsuitable for domestic use, and steps were taken to develop a new supply. The source selected was the Rockaway River, another affluent of the Passaic River to the south of the Pequannock. An impounding reservoir of 7,000,000 gal. capacity was built at Boonton, by means of a masonry dam flanked with earth dams and dikes, and a conduit about 23 miles long was built from it to the Bergen Hill reservoirs. The water flows by gravity. The system was put into service in 1904.

The system was built in accordance with a contract between the city and Mr. Patrick H. Flynn, who agreed to provide a satisfactory water supply and build all the works required to convey the water to the city. The contract was assigned by Mr. Flynn to the Jersey City Water Supply Company, which built the works. Upon their completion the city took them over.

The Boonton reservoir is capable of supplying a minimum of 70,000,000 gal. per day. The average daily consumption has increased from 27,800,000 gal. in 1898 to 51,800,000 gal. in 1918, during which time the per-capita consumption on the basis of the estimated population has increased from 145 to 160 gal. daily. This high per-capita consumption is due mainly to the large number of railroad locomotives consuming water at the terminal yards. They use about 20,000,000 gal. per day.

BAYONNE, PASSAIC AND PATERSON

Bayonne, Passaic and Paterson, as well as Kearny, Montclair and a number of smaller cities and towns, get their water from the same source, although through the mediumship of different controlling water companies. All receive it from the Passaic River itself, through a pumping station and filter plant at Little Falls, about five miles above Paterson. From this plant, which was built in 1897–1900, the water is pumped about three miles into the Great Notch reservoir, a reservoir of about 150,000,000 gal. capacity on the ridge running south from Paterson. From this reservoir, the surface of which is 425 ft. above mean tide, the water is distributed by gravity to the various communities it serves.

This plant at Little Falls, and the Great Notch reservoir, were built by the East Jersey Water Company, which had previously undertaken the development of the Pequannock water supply for the city of Newark, and which in accordance with its privilege of selling water to other communities had developed a market which it desired to retain after it had relinquished the Pequannock system. Subsequently it sold all but a quarter interest in the Little Falls and Great Notch works to three other water companies, the Passaic, the Acquackanonk and the Montclair. These three companies serve Paterson, Passaic and Montclair respectively, as well as other communities. The East Jersey Water Company does no retail business, but delivers water to several distributing companies that depend on it for water, and also direct to several cities.

Bayonne — Bayonne began in 1882 to buy water from Jersey City. In 1895 the New York & New Jersey Water Company was formed, and it contracted to supply Bayonne with water. The company in turn contracted for its supply with the East Jersey Water Company and received first Pequannock and afterward Little Falls water, turned over to it at Kearny. The water comes via the old Jersey City reservoir at Belleville.

The city acquired the property and contracts of the New York & New Jersey Water Company in 1918, and now gets its water direct from the East Jersey Water Company, distributing it from the point of delivery in Kearny.

In 1917 the city's average daily consumption was about 9,200,000 gal., or 132 gal. per capita, according to estimates of the population. The city is growing rapidly, and the per-capita consumption has also increased considerably since 1900, because of the large manufacturing consumption. The present daily consumption is estimated at 12,000,000 gal. Larger mains from Kearny are needed, and an additional pipe line is being laid.

Passaic — Passaic, which has been served by the Acquackanonk Water Company since the incorporation of that company in 1867, first obtained its water from the canal of the Dundee Water Power & Land Company, later from a pond within the city and still later, beginning in 1890, from the Passaic Water Company, which had a pumping station on the Passaic River at Paterson. The Acquackanonk company continued to buy its water from the Passaic company when the latter company, about 1899, began to get that water from the new Little Falls plant; but in 1908 the Acquackanonk company acquired a quarter interest in the Little Falls and Great Notch works.

In 1917 the company supplied an average of about 7,200,000 gal. per day, or something less than 100 gal. per capita for an estimated population of 87,000 in Passaic and Clifton.

Paterson — The first waterworks to serve Paterson were built in 1895 by the Passaic Water Company. The water supply was taken from the Passaic River at a point below the falls in Paterson, and was pumped by water power. A short time later the intake was moved to a point north of the falls, where it remained until 1899. The company then began to draw from the Little Falls plant, in which it acquired a three-eighths interest in 1908.

The company built four reservoirs before the Little Falls plant was opened, the oldest of which was subsequently abandoned. The largest of these, the Stony Road reservoir, built in 1885, has a capacity of 25,000,000 gallons.

In 1905 the company began to serve industrial plants in Paterson from a large main laid from the dam of the Society for the Establishment of Useful Manufactures, built just above the Paterson falls.

In 1917 the company delivered an average of about 15,300,000 gal. daily, to serve an estimated population of 135,000, embracing the city of Paterson and the borough of Prospect Park.

Montclair — Montclair has been served since 1887 by the Montclair Water Company. The first supply was from wells. In 1893 the company began to obtain Pequannock water from the East Jersey Water Company, and it continued to do so until water could be obtained from the same company from its new Little Falls plant. The Montclair company acquired an eighth interest in the Little Falls plant in 1908. The Montclair company now operates the plant for itself and the other owners.

The average daily consumption supplied by the company in 1918 was 1,450,000 gallons.

Kearny, Harrison, East Newark, Bloomfield, Nutley and Little Falls get Little Falls water from the East Jersey Water Company by contract.

The total quantity of water pumped at the Little Falls station in 1918 was 15,968,000,000 gal., or about 44,000,000 gal. per day, or slightly less than the daily consumption of either Jersey City or Newark.

HOBOKEN, HACKENSACK AND INTERVENING COMMUNITIES

Hoboken and virtually all of the communities north thereof and east of the Hackensack River are supplied by the Hackensack Water Company, which was organized in 1869 to serve the village of Hackensack. A consolidation was effected in 1881 with small companies serving Weehawken, Union, Guttenberg and other communities.

The company obtains its water from the watersheds of the Hackensack River and Pascack Creek. Parts of the watersheds are in New York State, and to protect them the company has acquired a controlling interest in the Spring Valley Waterworks & Supply Company, which serves Sparkill and other small communities in New York within what may be considered the Port District.

The first works of the Hackensack company consisted of a small reservoir and pumping plant built in 1869 at Cherry Hill, just west of the Hackensack River at Hackensack. In 1880 the company obtained a contract to supply Hoboken, for which purpose a pumping plant was built at New Milford, about six miles above Hackensack. The water was pumped direct into a transmission and distribution system. A considerable percentage of it was and is pumped a second time to reach the high levels of Weehawken and other towns on the Bergen Ridge.

In 1906 the company built a storage reservoir of about 90,000,000 gal. capacity at Hillsdale, and it is now building one of 3,000,000,000 gal. capacity at Oradell, a short distance above the New Milford pumping station. It also has three equalizing reservoirs at Weehawken and a standpipe at Englewood.

Some forty-seven communities in Bergen and Hudson Counties are now supplied by the Hackensack Water Company. The most important of these are Hoboken, West Hoboken, Weehawken, West New York, Union, Hackensack and Englewood. In 1917 the average daily pumpage was about 30,000,000 gal., as compared with about 21,000,000 gal. in 1908. The estimated population served in 1917 was about 400,000, so that the average consumption was considerably less than 100 gal. per capita.

ELIZABETH

Elizabeth obtains its water supply from the Elizabethtown Water Company, which was incorporated in 1854. The company's plant is unable to supply the entire city, and the company buys water from four other companies, the Middlesex, the Piscataway, the Plainfield Union and the Short Hills. In addition the Elizabeth company has two emergency connections with the distribution system of Newark.

Originally the Elizabethtown Water Company obtained its supply from an impounding reservoir on the Elizabeth River near the north boundary of the city. This storage basin, known as the Urbino reservoir, has a capacity of about 30,000,000 gal. A second slightly smaller reservoir was built near by to act as a settling basin. In dry weather the drainage area of the two reservoirs yields only about 2,500,000 gal. per day.

In 1896 the company obtained an additional quantity of water from wells about 2½ miles southwest of the city, where it built a pumping station. From these wells, with the pumps operating twelve hours per day, 3,000,000 gal. per day are obtained.

A third pumping station, known as the Springfield station, was built in 1901 about 5½ miles southwest of the city to draw from a series of wells along the east branch of the Rahway River. These wells can supply about 6,000,000 gal. per day.

The Middlesex Water Company owns a reservoir of 180,000,000 gal. capacity on Robinson's branch of the Rahway River, about seven miles from the city. In 1915 the city received about 2,320,000 gal. per day of filtered water from this source, although in extremely dry weather it will yield only 1,000,000 gal. per day.

The Piscataway Water Company during 1915 pumped about 2,000,000 gal. per day from its station at Bound Brook, nineteen miles southwest of the city. The water was pumped from wells.

The Plainfield Union Water Company, pumping water from the city of Plainfield, eleven miles from Elizabeth, supplies El Mora, a residential section in the northwestern part of the city.

The Short Hills Water Company, drawing from wells about six miles northwest of the city, supplies about 1,000,000 gal. per day to the city.

Elizabeth has a high per capita consumption, which has increased from about 170 gal. daily in 1912 to more than 200 in 1918, according to estimates of the population supplied. In 1918 the average daily consumption was about 20,300,000 gal., for a population estimated at 100,000. There is little metered service.

PERTH AMBOY AND SOUTH AMBOY

The first waterworks for the city of Perth Amboy were built in 1882 by the Perth Amboy Water Company. The city acquired the works about 1890, and built new ones in 1892–1893.

Originally the supply was obtained from Tennent's Brook, where the water was impounded by means of a dam, whence it was pumped to a standpipe. In 1906 the city began to get water from wells about seven miles from the city. Additional wells have been driven from time to time, and the entire supply is now obtained from the wells, the reservoir on Tennent's Brook being kept in reserve for emergencies. The pumping station is located at Runyon, seven miles southeast of the city.

Perth Amboy is growing rapidly in population, and the per capita consumption is high and is increasing. In 1909 an average of 4,630,000 gal., or 140 gal. per capita, were supplied daily to an estimated population of 33,000. In 1918 an average of 10,460,000 gal. daily was supplied.

South Amboy obtains its water from Perth Amboy through a metered connection. In 1917 the city consumed an average of 465,000 gal. daily, or about 66 gal. per capita.

NEW BRUNSWICK

The first waterworks for the city of New Brunswick were built in 1865–1868 by the Brunswick Water Company. They were acquired by the city in 1873.

The supply is obtained from Lawrence Brook, an affluent of the Raritan River. An impounding reservoir at Weston's Mills, together with several mill ponds above the city's intake pond, give a total storage capacity of 277,000,000 gallons.

Water is pumped from the intake pond to a reservoir on a hill in the southern part of the city. The reservoir stores 15,000,000 gal. There is in addition a standpipe to furnish better pressure to the high parts of the city.

In 1917 the average daily consumption was about 3,000,000 gal. As the estimated population was 28,000, the per capita consumption was about 107 gallons.

Water Rates

The Commission has assembled for its own use and records considerable information relative to the water rates prevailing in the different communities of the Port. Owing to the variety of ways in which water rates are established, it is difficult to present this information on a comparable basis, and the Commission does not deem it necessary to attempt to do so.

Conclusion

There is no water-supply problem at the Port serious enough to impede its development along the lines set forth by the Commission. As the number of inhabitants increases the water consumption will naturally do likewise — at a faster rate if past performances are an index, possibly at a slower rate if more extensive metering results in greater economy. In any event, the communities must reach out farther and farther for their water. New York City must probably go to the Adirondacks within the next fifty years. Newark will need the Wanaque supply soon, and may in the dim future have to find still another source. Jersey City will have to increase its supply, and so some or all of the other cities and towns of the Port may outgrow their water facilities. But the abundance of untapped water in the Adirondacks and nearer districts of New York State, and in northern New Jersey, dispels any fear that the needs cannot be met as they develop.

CHAPTER 33

Disposal of Municipal Waste

A very serious problem for the communities of the Port District is that of the disposal of municipal waste. The harbor waters are badly if not dangerously polluted with sewage, and the degree of pollution is increasing, while no effective steps have been taken to improve conditions. The disposal of garbage and other refuse does not present quite so serious a problem, yet the means employed are far from satisfactory and result in further pollution of the waters. There is no interstate agency for the control of these matters, and the Commission believes there is a vital need for one. Whether or not the agency should be the Port Authority, there are aspects of the problem of which this Commission must take cognizance.

One of the respects in which the Commission is concerned in the problem is the condition of the harbor waters. The pollution of the harbor waters long ago drove away the marine borers such as infest other Atlantic ports and quickly destroy untreated timber under water, necessitating the use of something more expensive. Public health demands reduction or elimination of the pollution, which will probably mean the return of the marine borers. Again, it is imperative that the Commission's plans make ample provision of waterfront for loading garbage and rubbish on scows, inasmuch as a vast volume of this furnished by New York City alone must be floated either to sea or to reduction works in some part of the Port District. The Commission's plan must not interfere with the construction of disposal works to eliminate the pollution of the harbor waters, and such works to be effective must probably be more elaborate than are found anywhere else in the world. Finally, details of the plan which are likely to cause great increases in the amount of municipal waste at one point or another must not impose insurmountable obstacles to the disposal of such waste.

Sewage Disposal

Nearly all of the sewage created by the 8,000,000 inhabitants and the numerous industries of the Port District is poured in its untreated state into the waters of the inner harbor. Along the shores of Manhattan, especially in the East River, the water surges back and forth with the tide, and solid matter may remain indefinitely. In fact constant dredging of some slips is necessary to remove the deposits. The attempt of a number of the New Jersey cities to overcome the intolerable pollution of the Passaic River by conveying their sewage to the Upper Bay was met some years ago by legal opposition on the part of New York, and the matter is still pending in the courts as the Passaic Valley Sewerage Case. Meanwhile movements to eliminate the greater pollution caused by the City of New York itself have never progressed beyond the preliminary plans.

NEW YORK CITY SEWAGE

New York's sewers empty into the Hudson, East and Harlem Rivers and the Upper Bay at the most convenient points, and the sewage is in the untreated state. It is estimated that more than 700 tons of fecal matter flows in daily. Under average conditions 12,540 million cubic feet of water flows out through the Narrows on the ebb tide and 10,790 million cubic feet flows in on the flood tide. The velocity of the current in the Narrows is about two miles per hour. It is evident, therefore, that the currents cannot be relied upon to carry the matter away. As a matter of fact the East River water, though flowing rather rapidly, oscillates back and forth, so that test floats have traveled 108 miles up and down the river without passing out. There is also considerable oscillation in the Hudson and Harlem Rivers, although Hudson River water ultimately finds its way to the sea.

While the tidal movements have some refreshing effect, the benefit is restricted because the action is usually least where most needed, the currents are intermittent, the sewage and water do not always mix thoroughly and the solid matters are carried back and forth, some on the surface and some finally depositing in the bays and rivers.

There is no question that the sewage of New York contains dangerous bacteria. They can be communicated to human beings by bathing, fishing, handling of driftwood or eating of shellfish.

METROPOLITAN SEWERAGE COMMISSION'S PLAN

Various investigations and studies have been made with a view to alleviating conditions. In 1914 the Metropolitan Sewerage Commission, created by the New York Legislature in 1906, made an estimable report, after an exhaustive study of the problem. The plan as proposed involved the turning of all sewage possible, partly treated, into the relatively open waters of the harbor (the Lower Bay, Jamaica Bay, the Upper East River and Long Island Sound), the creation of an artificial island off Coney Island for the partial treatment of a large part of Brooklyn's sewage, and the discharge of only the sewage of Manhattan, and not all of that, into the Hudson and East Rivers.

The Commission divided the city into four divisions and proposed separate treatment for each. The divisions were the Upper East River, Lower East River, Jamaica Bay and Richmond. For the Upper East River division, which comprised nearly all of the Bronx, that part of Manhattan draining into the Harlem River and that part of Queens draining into the East River east of Hell Gate, all discharge into the Harlem River would be discontinued and the matter would pass into the East River after treatment at one of five points on both sides of the river. For the Jamaica Bay division, embracing the eastern part of Brooklyn and a large part of Queens, the sewage after partial treatment would be discharged into Jamaica Bay. For the Richmond division, comprising the north end of Staten Island, there would be partial treatment at three points prior to discharge into the Narrows and the Kill van Kull.

The Lower East River division, comprising all territory draining into the Hudson River or the East River below Hell Gate, and all Brooklyn territory draining into the Upper Bay, embraced most of Manhattan, a large part of Brooklyn and a small part of Bronx, and provided the most difficult part of the problem. The Commission proposed to continue for the present the discharge of Manhattan sewage into the Hudson and East Rivers, but well screened to remove large solids. Brooklyn sewage it would divert to the artificial island to be built north of Sandy Hook and about three miles off Coney Island, where it would receive treatment before discharge into the Lower Bay. This would remove much of the sewage burden from the land-locked Hudson and East Rivers, and ultimately the sewage from the east side of Manhattan could be siphoned under the East River and delivered to the artificial island.

BRONX VALLEY SEWER

North of New York City within the Port District most of the City of Yonkers discharges its sewage direct into the Hudson River, while a large volume is also discharged into the river by the Bronx Valley sewer, which, constructed in recent years, extends down the valley of the Bronx River from White Plains to a point just north of the New York city line and then turns westerly in a tunnel to the Hudson River. The sewer intercepts the sewage of White Plans, Scarsdale, Tuckahoe, Bronxville and parts of Mount Vernon and Yonkers. The sewage is partly treated.

Most of the sewage of Mount Vernon and all of that of New Rochelle and the communities to the east is discharged into Long Island Sound.

Sewage from a large number of communities along the Mohawk and Hudson Rivers beyond the limits of the Port District gives the Hudson a large burden of pollution at the point where it enters the district.

NEW JERSEY SEWAGE — PASSAIC VALLEY CASE

Conditions in New Jersey are no more satisfactory than on the New York side of the Port. The waters in the shallow Newark Bay oscillate back and forth before finally escaping into New York Bay, and the pollution of the tributary Passaic River years ago became such a menace that the New Jersey Legislature in 1907 passed a law prohibiting the discharge of raw sewage into the river. The following year the Passaic Valley Sewerage Commission applied to the United States War Department and obtained a permit to discharge under water near Robbins Reef, within the boundaries of New Jersey, the sewage from a trunk sewer it proposed to build down the Passaic valley and under Newark Bay and part of the Upper New York Bay. Construction was begun on this sewer, which was to serve about 100 square miles of the most populous territory of the State, from Paterson to Newark. The State of New York brought suit to block the project, and the matter is still before the United States Supreme Court. Pending the ruling of the Court, comment on the merits of the case by this Commission would be improper. It can be pointed out, however, that the question is an extremely serious one for both States.

Another joint sewer in New Jersey serves West Orange, South Orange, Irvington, Summit and parts of Orange, Newark and Elizabeth, discharging near the junction of the Arthur Kill and Newark Bay. This project was allowed only on condition that a treatment plant would be provided when the conditions demanded it, and such a plant is contemplated at the present time.

A number of communities discharge sewage into the Hackensack River, and a movement has been considered to build a trunk sewer in that valley, with a treatment plant near the head of the Hackensack Meadows. A number of communities also discharge into the Rahway River, which is badly polluted. Some of the smaller streams, such as Penhorn Creek on the west boundary of Jersey City, are little better than open sewers.

JURISDICTION OVER HARBOR

Sanitary jurisdiction over New York Harbor is exercised by the United States Government, the States of New York and New Jersey and the City of New York, but the regulations regarding sewage disposal are by no means strict. The main object of the Federal regulations is to prevent the dumping of solid matter to the injury of channels; that of New York State's supervision is the management of the quarantine, and the City's chief aim is to prevent local nuisances along the shore. Something has been accomplished by each of these agencies, but no far-reaching remedy for the pollution of the harbor has been found. There has been a general lack of co-operation. The Metropolitan Sewerage Commission was authorized when created to co-operate with a similar body created by the State of New Jersey, but the latter State never created such a body.

In view of the legal controversy in the matter of the Passaic Valley Sewage Case, the highly technical and specialized nature of the problem involved and the limited time at the disposal of the Commission, the Commission has made no attempt to solve the sanitary problem. That a solution is urgently needed is patent. The Commission does not believe that any part of its general plan will interfere in any way with whatever remedy may be adopted for the present insanitary conditions. Ultimately, if the harbor waters are cleansed to such a point as to make them habitable by marine borers, it may be found necessary to creosote all timber that is to be submerged, or even to use concrete construction. For the present this does not seem to be necessary, except in such waters as Jamaica Bay, where the marine borers are still able to thrive.

Disposal of Garbage and Rubbish

The disposal of garbage and other refuse, while a very large problem, is less obviously an interstate problem than that of sewage. It is generally conceded that garbage and rubbish must not be dumped into the harbor waters, and although the practice still prevails of dumping them at sea, where much of the matter washes back on the beaches of both States, there are probably few who advocate this as a permanent procedure. New York can reasonably be expected to dispose of her own garbage and rubbish, and the same can be expected of the New Jersey communities. At the same time the natural means of conveying the refuse to the disposal plants is by water, making it necessary to provide the required waterfront facilities, and the need for locating the reduction plants at such points and of such character as not to be offensive to other communities cannot be overlooked.

NEW YORK'S GARBAGE PROBLEM

Garbage disposal and refuse disposal for the City of New York are still in the experimental stage. Garbage disposal is in an especially chaotic state at present because of the recent opposition to and subsequent abandonment of the elaborate plant built in 1916–1917 on Staten Island. The city has gone back for the time being to the antiquated practice of dumping the garbage at sea, and the Commission has no information that substantial headway has been made toward a more satisfactory method.

Prior to 1895 dumping at sea was the accepted procedure. Aside from the expense of this it created nuisances, the garbage being blown shoreward in strong winds, and at times fouling the Long Island and New Jersey beaches, even as far south as Atlantic City.

In 1895 what was then the largest garbage-reduction plant in the world was built by a private company at Barren Island, at the entrance to Jamaica Bay. The plant was enlarged from time to time and remained continuously in operation until 1917, when the Staten Island plant was built. It had meanwhile taken over the garbage from Brooklyn and the Bronx. The essential features of the reduction process used were the steaming of the garbage in tanks until it was thoroughly cooked, the pressing out of the water and grease, the latter being recovered, the further pressing of the residue into cakes for fertilizer and the burning of the escaping gases.

In 1916 a plant costing $2,000,000 was built on the Arthur Kill in Staten Island. This plant was to reduce all garbage of Manhattan, Brooklyn and the Bronx for five years, after which it was to be turned over to the city. The Borough of Richmond vigorously opposed the building of this plant, but its opposition was overruled and the plant was built.

After the plant was put into operation the complaints continued. Meanwhile the machinery broke down repeatedly, and in March, 1918, the company went into a receivership. A committee investigated and reported bad odors all over the southern part of the island, and in July, 1918, orders were given to dump the garbage at sea. Attempts to rehabilitate the plant and to get the city or Federal Government, which needed the by-products, to operate it failed, and in the late autumn it was permanently shut down.

The Staten Island plant was supposed to embody the best obtainable in the scientific reduction of garbage. Its chief difficulty seems to have been lack of capacity, so that garbage in scows became highly offensive before it could be put through the plant.

Dumping of the garbage at sea following the discontinuance of the Staten Island plant caused so many complaints that the company that had operated the Barren Island plant was asked to reopen it. Considerable money was spent in rehabilitating it, but the plant was unequal to the present demands and the cost to the city, dependent as it was on a day-to-day contract, was excessive. Hence the attempt to utilize the plant was abandoned, and now all garbage is being dumped at sea.

NEW YORK'S RUBBISH

Up to 1895 all of Manhattan's refuse was dumped on low-lying waterfront ground, land on both sides of the island below Forty-second Street being reclaimed in this way, or it was towed to sea. There was at that time no separation of garbage and rubbish. Colonel Waring in 1895 instituted the separation. Since that time the practice of burning the rubbish, either at incinerators or on open dumps, has been developed. The work, aside from that performed by a municipal plant at Flushing and another in the Bronx, is done by private companies at considerable cost. The sanitary conditions at the land dumps and at the waterfront dumps as well are a public menace. They also create a fire risk, as fires can neither be prevented nor easily put out.

NEW JERSEY'S REFUSE

Refuse is collected from most of the New Jersey communities by private companies or individuals under contract. In some of the communities the garbage, ashes and rubbish are collected separately, in others the mixed system is in use. In the main the material is deposited in private land dumps, some of which are nearly filled up, and some of which are quite offensive.

OTHER PHASES OF REFUSE REMOVAL

There are numerous other phases of the problem of refuse removal, such as the disposal of trade wastes from stores, factories, hotels and restaurants, and the removal of dead animals. The wastes need not be entirely waste. In other cities the garbage is used as feed for hogs, or the grease and other valuable by-products are extracted, so that while New York and most of the other communities of the Port pay to have their garbage removed, some cities are able to sell it. In the matter of rubbish, also, there is considerable salvage.

The problem at the Port of New York is much greater than anywhere else in this country, and the first essential is that the material be removed before it becomes a menace to health or an obstruction to traffic. Nevertheless there is warrant for scientific study to determine whether the wastes are assets or liabilities, and whether they should be destroyed as completely as possible or separated into their valuable and valueless elements, and only the latter be destroyed.

Snow Removal

One other phase of the general problem of the disposal of municipal wastes which has a vital bearing, as the past winter proved, on the operation of the Port as a port, is the question of snow removal. The virtual disappearance of sleighs from the business streets of the Port District and the large increase in the percentage of motor vehicles have made it necessary to remove snow from the pavements as soon as possible after a storm. The regular street-cleaning forces of New York City and the other communities are not able to cope with a heavy storm, and the work has ordinarily been done by contract.

Early in February of this year a storm came which impeded traffic, particularly in New York City, more seriously than any other storm in the records of the Port District. The snow, which did not exceed a total depth of six or eight inches, came in a series of layers of snow, sleet and rain. Neither the contractors nor the city succeeded in assembling a sufficient number of laborers to make any impression on the snow before it had under the impact of vehicular traffic become packed and frozen into ice, very rough and of unequal depth. Vehicular traffic was brought almost to a standstill, even on the most important streets, and it was nearly two weeks before normal conditions were restored in the business streets, the residential streets not recovering during the entire month. The losses due to delays in the movement of goods, damage to motor trucks and other vehicles and the general derangement of business were incalculable.

The system of snow removal in vogue in New York City, where the problem is most acute, depends upon the quick assembling of a large amount of floating labor. Usually the men will not come out in force while the storm continues or while it is very cold. The methods employed, too, are unduly costly. The snow is shovelled into high trucks, mostly horsedrawn, hauled to the waterfront and dumped off piers or bulkheads. Several methods of payment have been tried, but the most common one is on the basis of actual contents of the loaded trucks.

In 1914 Mr. J. T. Fetherston, at that time street-cleaning commissioner, introduced a system known as "snow fighting". As soon as a snowstorm began the regular street cleaning forces and as many laborers as could be had by the city were set to work clearing cross-walks and gutters, and removing the snow around hydrants. Then as far as possible the snow was shovelled or even dumped into the sewers.

An objection to this method is the likelihood of street refuse of all sorts getting into and clogging the sewers. The method was more effective, however, than that employed during the past winter or than anything tried prior to 1914. It is evident that even if the cost be high the snow must be removed before it has an opportunity to become packed into ice. During the past winter most of the material removed was solid ice, which had to be cut away with picks.

The communities on the New Jersey side of the Port suffered less from the snow of the past winter than New York City did. They were able to recruit sufficient forces to attack and remove the snow before the traffic had converted it into ice. The removal was expensive, however, and the entire problem deserves careful study.

Conclusion

The disposal of all of the many kinds of wastes the Port District produces is in itself a large problem. There should be a continuing organization to study it with a view both to safeguarding the public health and to salvaging whatever may be of value. As far as the plan of this Commission is concerned, it does not appear to interfere in any way with the best solution of the various phases of the wastes problem. Space is available for waterfront facilities required for the disposal of garbage and rubbish, while satisfactory garbage-disposal works can doubtless be constructed as may be required without conflict with the Commission's plan.

It should be borne in mind in the design of waterfront structures that the present heavy burden of sewage in the harbor will some day be reduced in the interests of public health, and when that day comes the destructive marine borer will return. Consideration should be given now, therefore, to the desirability of safeguarding structures under water against his attack.

PART III

Compact Between New York and New Jersey for the Creation of a Port Authority and the Comprehensive Development of the Port.

In his message of February 18, 1918, transmitting to the New York Legislature the preliminary report of this Commission (Legislative Document 31), Governor Charles S. Whitman said: "The recent decision of the Interstate Commerce Commission in the New York Harbor Case has brought to the attention of the people of the two States, as never before, the important fact that *the Port of New York is historically, geographically and commercially one port and that any congestion in the port at any one point affects the whole port.* While this port is undoubtedly the greatest port in the world and is at this very time performing a war service of incalculable value, its facilities have not been properly co-ordinated. Its size and complexity have led to serious and grave situations. The time has come to look forward and to plan in advance for the future demands that will be made upon the port. *Haphazard, piecemeal attempts to solve the terminal problem at the port will hinder, not hasten, the desired solution.* It is the universal opinion of all those who have studied the matter that there must be a careful, scientific study of *all* of the conditions at the port and a weighing and comparison *of the cost and value of all suggested* improvements. This cannot be done by any commission representing either State alone. *The task must be a joint task.*"

The New York, New Jersey Port and Harbor Development Commission itself represents the registered will and purpose of the two States to engage in this joint and common undertaking.

The investigation and studies made by the Commission very early convinced the Commission that, whatever physical plan might ultimately be worked out, it was essential that the two States be brought together in an agreement or compact fixing the basis and terms of co-operation, and providing for legal machinery through which this co-operation could be made effective. The Commission, therefore, requested its counsel to make a careful and exhaustive study of all the legal phases of the problem.

Study of Legal Precedents

Such a study was made and is contained in the "Preliminary Report of Counsel to Accompany the Tentative Draft of Proposed Treaty Amendatory and Supplementary to the Treaty of 1834," annexed to the Progress Report of the Commission for 1919 (Legislative Document 103). This study brought together the precedents bearing upon the problem and discusses at length the history of the early commercial relations between New York and New Jersey; the boundary dispute; the treaty of 1834; the purpose and meaning of that treaty; the Federal power over interstate commerce and navigation; the powers of the two States, covering the title to shore-front property both in New Jersey and New York, the regulation of waterfront franchises, the various agencies — corporations, municipalities or other delegated powers — through which the States may act, the legal basis for interstate action and the treaty or compact-making power of the States; the experiences in international law in dealing with such problems; the methods for the enforcement of an interstate treaty; State limitations upon borrowing capacity, and other phases of the problem. This report is regarded by experts as the first compilation of authorities upon these phases of the problem of Port development. It is revised and brought down to date further on in this chapter.

The Commission concluded that the structure of a Port Authority for the Port of New York should be built upon the firm foundation of the New York-New Jersey treaty of 1834. It concluded, further, that in such an amendment of the treaty account should be taken of what is now known as the "Metropolitan District" and that commercially, as well as historically, the district is in fact, if not in law, one district. Difficulties at once suggest themselves in the erection of such an authority: To what extent *can* power be vested in such an authority? To what extent *should* such power be vested? What power shall such a port authority possess over municipalities and communities embraced within the territory? How shall it deal with property, title to which is now vested in such localities? What shall become of the bonded indebtednesses of these various communities and of their constitutional debt limitations, especially in the case of New York City? On the one side are all the municipalities and townships now embraced in Greater New York, organized into one large single political unit; on the other are various small units still unorganized. How, if at all, shall these units be represented, and how shall their authority be balanced? These questions are not entirely legal questions. They do, however, present legal phases. They are in the main *political* questions. They must take account of the habits of thinking and feeling of all of these communities, as well as of the legal principles involved.

The legal problem is unique. As was stated by counsel in his report, "At the threshold we face the fact of a dual political sovereignty. The Port lies in two States, each an independent sovereignty in its own land. The legal problem, therefore, cannot so easily be stated or solved as it might be for New Orleans, Philadelphia, Boston or Baltimore. Again, traffic between two States across boundary waters is interstate commerce. Neither one State nor the other can wholly regulate the Port."

If it is important to overcome the physical barriers that separate the two States, it is of even greater importance to overcome the legal barriers. The Commission felt that the *im*plicit obligation of the legislation under which it was created should be reduced to the form of a compact whose terms should be *ex*plicit and definite — a compact by which the States should cooperate through a common agency in the development of port facilities. It was convinced that there were no constitutional or legal difficulties in the way of such a compact and that it should supplement the existing compact between New York and New Jersey made in 1834, a copy of which is contained in the report of counsel to the Commission.

TENTATIVE DRAFT OF TREATY SUBMITTED IN DECEMBER, 1918

Acting under instructions of the Commission, accordingly, counsel to the Commission prepared a tentative draft of such a compact. (A copy of this follows this chapter and is marked Appendix A.)

Accompanying it was the following notice:

> For the purpose of developing a legal plan for the carrying forward of such constructive recommendations as shall ultimately be approved, the Commission now presents for public discussion and consideration a proposed treaty between the two States, looking to the creation of a single Port Authority. Accompanying the tentative treaty is a report from the Commission's counsel, discussing the legal phases of the problems presented to the Commission.
>
> Criticisms and suggestions should be sent to the secretary, at the office of the Commission, 115 Broadway, New York City. A limited number of copies of the report of counsel accompanying the treaty are available for organizations or individuals desirous of making suggestions or criticism of the plan.

A copy of the draft was sent to all members of the Legislatures of both States, to the Mayor and other members of the Board of Estimate and Apportionment of New York City, to other municipal officials within the metropolitan district, to civic and commercial bodies and to the press.

FIRST PUBLIC CONSIDERATION

The first public consideration of this draft was given at a meeting held at the New York Chamber of Commerce December 19, 1918, at which were present Hon. Charles S. Whitman, Governor of New York; Hon. Walter E. Edge, Governor of New Jersey; Hon. Charles E. Hughes; Hon. William D. Guthrie; Hon. John O. H. Pitney; Hon. Byron R. Newton, Collector of the Port; Mr. Alfred H. Smith, Regional Director of Railroads; Hon. Charles L. Craig, Comptroller of the City of New York; Hon. Edward Riegelmann, President of the Borough of Brooklyn; Hon. Murray Hulbert, Commissioner of Docks, City of New York (not at that time a member of this Commission); the members of this Commission, its counsel and its consulting engineer.

At this time both Governor Whitman and Governor Edge took occasion to pledge their support to the proposed compact.

The main features of the proposition almost at once received general popular approval. The New York Chamber of Commerce, Merchants' Association, City Club, Citizens' Union, Brooklyn Chamber of Commerce and Newark Board of Trade all gave their hearty support to the project. The metropolitan press was almost unanimously for it. Among the papers supporting it were the *New York Times, World, Sun, Tribune, Herald, Journal of Commerce, Globe, Evening Post, Evening Mail, Evening World and Evening Sun, the Newark Evening News* and various other New Jersey papers.

At the request of Governor Edge the State Bar Association of New Jersey appointed Messrs. Gilbert Collins and Marshall Van Winkle of Jersey City, Edward M. Colie and Robert H. McCarter of Newark, Wayne Dumont of Paterson, William R. Wilson of Elizabeth and Adrian Lyon of Perth Amboy a special committee to consider the proposed draft. The committee approved of its legality.

Committees of the various bodies endorsing the plan made careful study of the details, and valuable suggestions and criticisms were received by the Commission and its counsel.

PUBLIC HEARINGS

Public hearings were held at Newark and New York City on January 18 and 22, 1919, respectively.

At the Newark hearing the treaty was discussed by Messrs. D. Grotta, president of the Newark Board of Trade; Morris R. Sherrerd, chief engineer of the Department of Streets and Public Improvements, City of Newark; R. C. Jenkinson, vice-chairman of the New Jersey State Board of Commerce and Navigation; Peter Campbell, W. J. Bartnett and others. The discussion was distinctly favorable to the treaty.

At the New York hearing Messrs. John F. Wallace, representing the Chamber of Commerce of the State of New York; R. C. Harrison for the City Club; F. B. DeBerard, for the Merchants' Association; William McCarroll; Louis L. Tribus, representing the Staten Island Chamber of Commerce; S. Wood McClave, of the Eastern Bergen County Association of New Jersey; Hon. Byron R. Newton, Collector of the Port of New York; Charles Whiting Baker, John H. Ward, Lindon W. Bates and H. McL. Harding, spoke in favor of the principle of the treaty. Charles Campbell spoke in opposition.

PRESENTATION TO LEGISLATURES — BI-STATE LEGISLATIVE COMMISSION

On January 29, 1919, a conference was held at Albany between Governors Smith and Edge, the members of the Commission and their counsel, and the following members of the Legislature of New York: Lieut.-Gov. Harry C. Walker; Hon. J. Henry Walters, president pro tem of the Senate; Hon. James A. Foley, minority leader of the Senate; Hon. Thaddeus C. Sweet, Speaker of the Assembly; Hon. Simon L. Adler, majority leader; Hon. Charles D. Donohue, minority leader; Hon. H. E. Machold, chairman of the Ways and Means Committee of the Assembly; Hon. Murray Hulbert, Commissioner of Docks, City of New York, and Hon. Edw. J. McGoldrick, assistant corporation counsel, City of New York.

At this conference the draft of the compact was presented and discussed, and it was agreed that in order that it might be presented in complementary form to the Legislatures of both States a legislative bi-State commission should be appointed, which should co-operate with the Commission in the revision of the compact. Accordingly Hon. J. Henry Walters, president pro tem. of the Senate; Hon. Thaddeus C. Sweet, Speaker of the Assembly; Hon. Henry M. Sage, chairman of the Committee on Finance of the Senate; Hon. H. E. Machold, chairman of the Committee on Ways and Means of the Assembly; Hon. Alvah W. Burlingame, Jr., and Hon. Louis M. Martin, chairman respectively of the Committees on Judiciary of the Senate and the Assembly; Hon. James A. Foley, minority leader of the Senate; Hon. Simon L. Adler, majority leader of the Assembly; Hon. Charles D. Newton, Attorney-General; Hon. Frederick A. Wells and Hon. George R. Fearon, members of the Assembly; Hon. Murray Hulbert, Commissioner of Docks of the City of New York; Messrs. William P. Burr and Edward J. McGoldrick, corporation counsel and assistant corporation counsel of the City of New York, and Mr. Robert C. Cumming, legislative bill drafting commissioner, were appointed to represent New York, while Hon. Thomas F. McCran, Attorney-General; Hon. Clarence E. Case and Hon. Henry E. Ackerson, Jr., majority and minority leaders of the Senate; Hon. Arthur A. Pierson, Speaker of the Assembly; Hon. Ralph K. Kellam and Hon. Hugh C. Barrett, leaders of the Assembly, and Mr. John J. Milton, corporation counsel of Jersey City, were appointed to represent New Jersey.

CONFERENCE AT CHAMBER OF COMMERCE

On February 15, through the courtesy of the New York Chamber of Commerce, the Commission met at the Chamber and considered the proposed compact. There were present: Governors Smith and Edge; Lieutenant-Governor Walker, Senators Walters, Sage, Foley and Burlingame, Speaker Sweet, Assemblymen Machold, Adler, Donohue, Martin, Wells and Fearon, Attorney-General Newton for the State of New York, Corporation Counsel Burr and Assistant Corporation Counsel McGoldrick for the City of New York; Senators Runyon, Case, Ackerson, Edwards and Whitney, Assemblymen Pierson, McAcer, Kellam, Barrett and Winne, Attorney-General McCran, Comptroller N. A. K. Bugbee and State Treasurer William R. Read for the State of New Jersey; the members of this Commission, its counsel and others.

The conference adjourned to March 1 after appointing a sub-committee to revise and redraft the proposed compact, consisting of the Attorneys-General of both States, the majority and minority leaders of both Houses of both States, and the corporation counsels of New York and Jersey City.

The subcommittee met February 21 and considered all criticisms and suggestions that had been made, and instructed counsel for the Commission to revise the draft and present it for further consideration to the subcommittee prior to the meeting of March 1.

At the adjourned meeting of the bi-State Commission held March 1 at the Chamber of Commerce, Governor Smith, Speaker Sweet and Senator Walters requested an adjournment of the conference until the administration officials of the City of New York might be given an opportunity to consider the proposed draft and express their views thereon. The conference, accordingly, adjourned subject to the call of the chair as soon as the New York legislative section of the conference was ready to report. Mr. Walters, president pro tem of the Senate, addressed a communication to Mayor John F. Hylan and Hon. Robert L. Moran, President of the Board of Aldermen of New York City, a copy of which appears as Appendix B.

A copy of the compact as revised up to this time appears as Appendix C.

HEARING BEFORE NEW YORK CITY BOARD OF ESTIMATE

The matter having been set down by the Board of Estimate and Apportionment of New York City for a public hearing on March 26, the Commission and its counsel attended and counsel for the Commission, by direction of Governor Smith, outlined the history and purpose of the proposed compact. The hearing continued through the day, and on the following day besides the Commission's counsel there appeared in support of the treaty Mr. George W. Wickersham, for the New York Chamber of Commerce; Mr. Samuel Untermyer, representing the Yonkers Waterfront Development Commission and the Merchants' Association of the City of New York; the late Col. Henry W. Hodge, representing the Citizens' Union; Mr. Nelson S. Spencer, representing the City Club. and Messrs. J. S. Davis and F. L. Cranford, representing the Brooklyn Chamber of Commerce.

There appeared in opposition Mr. Charles F. McLean, representing the New York Board of Trade and Transportation, Messrs. Cyrus C. Miller, Calvin Tomkins, Murray Hulbert, Dock Commissioner, and others.

On April 4 the Board of Estimate and Apportionment adopted a resolution (Appendix D) in which the board expressed itself as "impressed with the necessity for co-operation between the two States * * * to develop the Port of New York," and "ready to immediately consider and carefully study any comprehensive plan having that for its object"; but believed that the "presentation and adoption of such comprehensive plan should precede the making of the proposed treaty granting such vast powers for all time to the Port Authority in the Port District to be created thereby."

The board recommended that this Commission be continued in existence so as to permit it, as a result of the studies it had already made and was still making, to present such comprehensive physical plan for examination and study, together with a comprehensive statement of the ways and means to carry such plan into effect. It is also stated that "the active and earnest co-operation of New Jersey" is invited by the board "in any movement tending to improve and develop the Port of New York in all its parts and to the fullest extent, including matters relating to river and harbor pollution, which now constitutes a grave menace to the harbor of New York, and the abatement of the nuisance arising from the poisonous fumes generated in the factories or plants situated on the New Jersey shore opposite Riverside Drive, which nuisance is most injurious to the health and detrimental to the property of the people residing in that locality."

Action Deferred

Following this, the bi-State conference reconvened at the call of the chairman on April 5 and the conference unanimously adopted the following resolution:

"*Resolved:* That to the end that a compact between the two States may be submitted to the next Legislature of each State, amended in the light of suggestions made and to be made, the present conference be continued and the legislative subcommittee of each State be instructed and directed to confer with the New York, New Jersey Port and Harbor Development Commission and its counsel and present at an adjourned meeting of this conference, to be held at such time as the subcommittee is ready to report, a revision of the present revised draft of the proposed compact between the States which shall take account of all suggestions that have thus far been made or may hereafter be made; and be it further

"*Resolved:* That it is the sense of this conference that pending the consummation of such compact and the working out of a comprehensive plan for the development of the Port, all projects for terminal facilities within the Port of New York shall be submitted to the New York, New Jersey Port and Harbor Development Commission for consideration and advice, to the end that so far as practicable all such projects shall be in harmony with such comprehensive plan when ultimately adopted; and be it further

"*Resolved:* That the New York, New Jersey Port and Harbor Development Commission continue its work; and each State make the necessary appropriation therefor; and that the Legislatures of each State continue the present Bi-State Legislative Commission."

Main Criticisms of Compact

The main criticisms of the form of the compact developed by the public discussion before the Board of Estimate and Apportionment, with the arguments pro and con, were as follows:

Constitution of Port Authority

It seemed to be the opinion of the members of the Board of Estimate and Apportionment that the New York section of the Port Authority should be made up of the Board of Estimate and Apportionment as a whole, or that at least two of its members should be members of the board.

In support of this proposition the argument was made that since the interests of New York City are so large and extensive and the consequences to the city's development so direct and immediate, the city should have virtual control of the New York section of the Port Authority. It was argued also that the principle of home rule applied to an agency having so much to do with the future development of the States.

Against the proposition, it was argued that the future development of the Port would require a continuing body acquiring its knowledge by experience and not subject at any time to being made the football of politics; that such a continuing authority exists at all other important ports; that without it there would be no adequate consideration given to the great problems of the Port, and that the history of all administrations in the past shows that the members of the Board of Estimate and Apportionment are too busy with other matters to give time and attention necessary to Port problems. It was pointed out, furthermore, that the Port is not only a *city* matter but a *State* matter.

The opinion of the Commission is that the matter of selecting membership in the Port Authority is properly a subject for *legislation* and should not be embraced in the treaty. Article IV as originally drafted provided that the New York members were to be chosen by the State of New York and the New Jersey members by the State of New Jersey "*in the manner and for the term fixed by the Legislatures of each State.*"

Veto Power of the Governors

It was provided that each State reserved the right hereafter to authorize the vetoing by its Governor of any action of the Port Authority. It was argued before the Board of Estimate and Apportionment that this would give either Governor power to hold up any improvement, no matter how desirable, and though concurred in by the Port Authority.

Harbor Pollution

It was provided that until otherwise determined by the Legislatures the term "rule or regulation for the improvement of the conduct of navigation and commerce within the district," shall not include matters relating to harbor or river pollution.

It seemed to be the opinion of the members of the Board of Estimate and Apportionment that this reservation should not be made. There is still pending in the United States Supreme Court a suit of the State of New York against the State of New Jersey and the Passaic Valley Sewerage Commission to restrain the construction and operation of the trunk-line sewer to be built for the purpose of conducting the discharge of sewage to a point in New York Bay. The original bill in this suit was filed October 7, 1908, and by a recent order of the United States Supreme Court entered March 10, 1919 (249 U. S. 202), the case was reopened for the purpose of taking additional testimony and was argued in the United States Supreme Court by counsel for both states, Hon. Charles E. Hughes for New York and Hon. George W. Wickersham for New Jersey, on January 25, 1921. It has been stated both in New York and New Jersey that the inclusion in the proposed compact of matters of harbor pollution might embarrass the United States Supreme Court in the decision of the pending litigation. When the compact was first under public discussion the suggestion was made by representatives of the Merchants' Association as well as by the committee of the New Jersey Bar Association that for the time being this matter be reserved. The history of this matter has an important bearing upon our problem.

By Chapter 539 of the Laws of 1903 the New York Legislature appointed a commission to investigate certain threatened pollution of waters in New York Bay, the commission consisting of Messrs. Daniel Lewis, chairman, Olin H. Landreth, George A. Soper, Myron S. Falk and Louis L. Tribus. This commission made its first report on March 31, 1905, and its second report April 30, 1906. In its report of March 31, 1905, it emphasized in the following language the needs of the metropolitan district as a whole and the desirability of joint State action:

> "It has been suggested, therefore, that a metropolitan sewerage district should be established, to include all sections in both New York State and New Jersey which now or in future may sewer into the bay and its tributaries. This district, when authorized by joint State and Federal legislation, should be under the direction and control of a permanent interstate commission, with plenary power to control the discharge of all sewers hereafter constructed, as well as the task of evolving a comprehensive plan for ultimately rendering the present chaotic and systemless method of sewage disposal sanitary and suitable for all future requirements.
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> "There seems to be no possibility of a comprehensive treatment of this great question through the action of various and constantly changing local authorities, acting independently. Manhattan may continue, as at present, to follow no system whatever, simply emptying a new sewer into the North or East River at any place where grades permit, even though a recreation pier or public bath may be already established at the same point. Brooklyn may, and probably will, carry its sewage into the sea, and thus ruin the bathing beaches within its limits, and pollute the great oyster beds therein, and Westchester County for forty miles from the city may contribute a large amount of sewage, while the State of New Jersey, with its constantly increasing population, will add to its present outflow from year to year.
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> "The necessity also exists for a central authority to not only direct, but also initiate, these great public works, upon which depend the beauty and healthfulness of the approximately 450 miles of shore within the metropolitan district.
>
> "Immediate action should be commenced to secure such an interstate commission, for the existing conditions must steadily approach the point where the public will demand relief.
>
> "In this country there is at present but one locality at all analogous to New York in this respect, viz., Boston, where a great metropolitan district empties its sewage into the harbor, but the difference in governing conditions is radical, as but one State is in control, while for New York Harbor two great commonwealths would have to join forces.
>
> "England permitted the pollution of the Thames for centuries, but at last was compelled to purify its waters at a cost far exceeding the expense of *preventing* such contamination had the demands of competent judges been complied with a hundred years ago.
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> "If New York and New Jersey should now initiate the plan above outlined the mistakes of other great municipalities could be happily avoided."

In support of the policy urged by that commission it obtained from Attorney-General John Cunneen an opinion upon the question "whether in the event this commission finds it desirable to recommend for future consideration the establishment of a metropolitan sewerage district, covering parts of the two States of New York and New Jersey, the Legislatures of the two States have authority to establish such a district and appoint a commission having adequate powers of administration," the Attorney-General answering the question as follows: "I am of the opinion that the States of New York and New Jersey may, if they see fit, construct a metropolitan sewerage district, covering parts of the territory of the two States, and giving jurisdiction thereover to the courts of one or the other of said two States, as to all matters pertaining to the proper sewerage of said district. Such concurrent acts of the States of New York and New Jersey should, however, in my judgment, be approved and ratified by an act of Congress, for the reasons hereinbefore set forth, namely, that the Federal Government has supreme control over the navigable waters of the Hudson River and New York Bay, and its approval should, therefore, be had to the joint action of the contiguous States."

Notwithstanding the very wise suggestion on the part of the New York Bay Pollution Commission, no attempt has been made since 1906 to bring the States together in a compact which would cover this important matter and create the central authority recommended by the commission of 1903.

Our Commission was not charged primarily with the duty of considering the matter of harbor pollution, but it has no hesitancy in adopting and agreeing with the conclusions quoted from the report by the New York Bay Pollution Commission. If it were not for the pendency of the litigation in the United States Supreme Court, it would urge the wisdom of now adopting, *after fourteen years' delay*, the recommendations of the New York Bay Pollution Commission.

VETO POWER FOR NEW YORK CITY

At various points in the discussion before the Board of Estimate and Apportionment and in the argument made by its corporation counsel, Mr. William P. Burr, it was urged that the action of the Port Authority in the making of rules and regulations, as well as in the carrying forward of constructive plans, should be subject always to the consent of the Board of Estimate and Apportionment of New York City. Such a provision, in the judgment of the Commission, would tie the hands of the Port Authority and preclude it from going forward with its work.

The Commission realizes that there are many phases of Port development in which the assent of the authorities of the City of New York should be obtained, and that this is equally true of other municipalities in other parts of the proposed district. The Commission is of the opinion that this should be worked out in the legislation to accompany the physical plan, and should not form a part of the treaty.

FLEXIBILITY IN THE COMPREHENSIVE PLAN

It was urged that the provision in the proposed compact, as originally presented, "that no change in the plan for the comprehensive development of the Port after it had been adopted by the Legislatures of the two States shall be made except by and with the approval of the Legislatures of both States," would preclude necessary changes in the physical plan that would develop as time went on. It is now clear from the Commission's complete report that it was not the aim to present a comprehensive physical plan so inflexible as to preclude any change. The plan distinguishes between what are "main features" or "fixed points" and such features as are treated as matters of detail.

REVERSION OF PROPERTY TO THE CITY

It was explained to the members of the Board of Estimate and Apportionment that in case of any improvement made by the Port Authority by contract with the city in which the consent of the city was essential, for the crossing or closing of streets, or in which a franchise grant from the city was essential, the city would doubtless require that the property when paid for should revert to it. Members of the Board of Estimate and Apportionment seemed to think that there should be a definite provision in the treaty to cover such a situation. Since, however, the project could not be consummated without the consent of the city, it seemed reasonable to assume that the administrative authorities would make such a provision a condition of the grant or franchise.

Further Consideration of Compact

Pursuant to the resolution of April 5, 1919, the Legislative Commission of each State was continued, the Legislature of New Jersey passing a resolution, a copy of which appears as Appendix E. The Legislative Commission, through subcommittees, had many sessions in conference with the counsel of the Commission and went very carefully over the criticisms and suggestions that had been made and it finally agreed upon a revised draft of the compact, which was subsequently embodied in the bills introduced by Senator J. Henry Walters in the Senate of New York, by Assemblyman Simon L. Adler in the Assembly of New York, by Senator Carlin B. Allen in the Senate of New Jersey and by Assemblyman Harry G. Herschfield in the Assembly of New Jersey.

Copies of the bills as introduced in New York and New Jersey are hereto annexed as Appendices F and G.

Before coming to their final conclusions upon the revision of the compact, our Commission desired again to obtain, if possible, the aid of the criticisms, counsel and suggestions of the Board of Estimate and Apportionment of the City of New York, especially in view of the fact that it was not practicable to complete the report of the Commission in all respects nor to present any comprehensive physical plan before the adjournment of the Legislatures of both States. In order to save a year's delay and to secure the consideration of the legislation at the 1920 session of the Legislatures, the chairman of our Commission addressed a letter on January 12, 1920, bringing the situation fully to the attention of the Board of Estimate and Apportionment and requesting that, in order that the draftsmen of the proposed compact might have the benefit of the criticisms, counsel and suggestions of the Board of Estimate and Apportionment, the Board reconsider its action of April 4, 1919, and give to the Legislative Bi-State Commission the benefit of such criticisms, counsel and suggestions. In response to this the Board of Estimate and Apportionment officially requested the Commission to present a statement as to the reasons why the resolution adopted by the Board of Estimate and Apportionment on April 4, 1919, should be reconsidered, and a statement of the reasons for the approval of the proposed revised treaty.

In response to such request, counsel for the Commission prepared and submitted the memorandum reproduced as Appendix H.

Counsel for the Commission attended a public hearing held by the Board of Estimate and Apportionment and urged upon the Board, on behalf of the Commission, the great importance of avoiding delay and the earnest desire of the Commission in charge of redrafting the compact for the benefit of the criticisms, suggestions and counsel of the Board of Estimate and Apportionment.

REVISED COMPACT SUBMITTED

The Board of Estimate and Apportionment determined not to reconsider its action. The Commission (except Commissioner Hulbert), was so impressed with the necessity for avoiding delay that it joined with the members of the Legislative Drafting Commission in recommending to the Legislatures the adoption of the compact as finally revised by the Legislative Drafting Commission, making it a part of the Commission's report of March 19, 1920, Legislative Document 97. In this report our Commission said:

> "Having already recommended the establishment of a unified Port District, then in line with all other great world ports, there should be a single Port Authority for efficiency of administration and for unified standards of development to replace the present divided authority exercised by both States and a number of municipalities. A Port Authority is the first step towards securing a proper development of the harbor, as is evidenced by the world ports where such authority has been created.
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> "The time is at hand when definite action must be taken if the Port of New York is to measure up to the demands that are and will be made upon it. The Port is not a local matter but a great national asset; so it must be regarded and treated; local jealousies, fears and policies must give way to the good of the whole.
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> "The railroads failed to meet the demands brought by war conditions, due largely to the insufficiency of terminals, and they were taken over by the Government. While the taking over of the railroads improved matters by effecting unified control and operation, it was not until a central organization was created under which all harbor facilities were united that order was restored and the functions of the Port were properly performed. The necessity for such a control was early recognized by the Commission, which initiated the steps which brought into being the War Port Board, Port of New York, and out of which grew the final centralized control by the Government.
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> "The United States at great expense has built up our American Merchant Marine, which it hopes to maintain, and in this enterprise adequate and proper facilities at the ports for the service of shipping are of prime importance. Handicapped as it is in competition with other maritime nations by our navigation laws, every means must be adopted to reduce the disadvantage and to cut out all the unnecessary delays and expense which the present antiquated facilities of the Port of New York now impose; otherwise, the business of our Port will decline and our Merchant Marine will suffer. The war emergency necessitated the central control to overcome the difficulties created by unscientific and unco-ordinated usages and which caused enormous delays and losses to our shipping, so that a Port Authority is just as important and necessary now as during the war.
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> "A year ago the Commission recommended to the authorities of the two States that a treaty be entered into between New York and New Jersey establishing the Port District and creating a Port organization which would have the necessary authority to handle Port matters. Such an instrument requires the subsequent sanction or approval of the Congress. The treaty is drawn so as to safeguard all interests. No other plan than that submitted will accomplish the purpose so satisfactorily to all interests and only through such a means can the Port progress and perform the part in national and world affairs for which it is so naturally and physically fitted.
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> "The proposed treaty or compact now safeguards the interests of all the municipalities and recognizes the principles of local self-government that are applicable. The Port Authority as created by the proposed compact is now limited in its powers so as to safeguard all the municipalities within the Port District.
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> "It is generally admitted that the facilities of the Port are becoming more and more inadequate to meet the needs. The existing conditions cannot be changed at once, but require time and money. They cannot be changed at all until a beginning is made by creating the authority to handle the work, and the time to begin is NOW.
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> "The port and terminal problem is the most important that the States of New York and New Jersey today have to face, because
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> "1. Its proper solution forms the basis of commercial prosperity of Nation, State and City. New York State and City and New Jersey have grown in spite of the fact that within the past twenty-five years in New York City but a small amount has been spent for improved and enlarged freight-handling facilities, while over $800,000,000 has been spent for improved passenger facilities.

"2. It affects very largely the welfare of each individual within the Port District through the high cost of living, as food, clothing, fuel and building material (influencing rent) represent over half of the freight transported therein, and the terminal cost of handling this freight represents a large proportion of the freight charges thereon.

"3. Due to its insular location the proper all-rail solution of this freight problem is especially essential to the health and safety of the public of New York City, in order to avoid the expensive and dangerous blockades of food, fuel and commerce due to weather conditions which we have so lately experienced.

"It has been claimed by some that action on the treaty should not be taken until the plans for the proposed changes and improvements are submitted, but this contention is not supported by the act nor is it logical or in accord with common sense.

"The act requires 'a joint report recommending a *policy* to be pursued, to the end that the Port shall be efficiently and constructively *organized* and furnished with modern methods, piers,' etc. Later on the enactment provides, 'Before making final report such Commission shall make a thorough study of Port conditions in this country, and shall take and employ such engineering, legal and other professional skill and assistance as it may need for the effective working out of a comprehensive and adequate interstate and Federal Port *policy* to meet commercial needs in times of peace and the protection of the harbor and adjacent localities in times of war.' The policy and the organization of the Port must precede any development or the adoption of any plan.

"No plan can be prepared that will meet the approval of everybody and of all interests; a Port Authority is needed to ascertain the views and requirements of those concerned, then decide what shall be done and act.

"A comprehensive plan can be prepared in all its details to meet the needs as they exist today, but time brings changed conditions and improvements of all kinds; any such plan must be modified accordingly and this becomes the duty of the Port Authority.

"Money will be required to finance the improvements — another duty that must devolve upon a properly organized and empowered Port Authority.

"In urging the creation of a Port Authority, the Commission is not proposing something new and experimental, but merely asking the adoption for the greatest harbor in the world of that which has been tried out with the best results both in this country and abroad.

"Accordingly the Commission urges upon the Governors and the Legislatures of both States the importance of having the proposed compact entered into now. It is submitted herewith in the form approved by the committees of the Legislatures of both States who have been at work on the draft."

GOVERNOR SMITH'S SPECIAL MESSAGE

On March 29, 1920, this report was transmitted to the Legislature of New York by His Excellency, Governor Alfred E. Smith, with a special message reading as follows:

"I have the honor to transmit to you herewith the Report of the New York, New Jersey Port and Harbor Development Commission, dated March 19, 1920, together with the proposed compact between New York and New Jersey recommended by the Commission as agreed upon by two legislative subcommittees from the States of New York and New Jersey.

"The Commission was appointed under Chapter 425, Laws of 1917, of the State of New York, and under Chapter 130, Laws of 1917, of the State of New Jersey. The legislation provided that the three commissioners from each State were:

'to negotiate or agree upon a joint report recommending a policy to be pursued by the State of New Jersey, the State of New York and the United States by legislative enactment or treaty or otherwise, to the end that said Port (Port of New York) shall be efficiently and constructively organized and furnished with modern methods of piers, rail and water and freight facilities, and adequately protected in the event of war. Before making such a report such Commission shall make a thorough study of Port conditions in this country, and shall take and employ such engineering, legal or other professional skill and assistance as it may need for the effective working out of a comprehensive and adequate interstate and Federal Port policy, to meet commercial needs in times of peace and the protection of the harbor and adjacent localities in times of war.'

"Under the foregoing provisions it is the duty of the Commission:

"1. To recommend a policy to be pursued by the two States which will secure an efficient and constructive organization of the Port of New York.

"2. To make a study of existing methods and facilities of the Port and to recommend a plan which will secure 'modern methods of piers, rail and water and freight facilities,' not only for present requirements but one which by expansion will meet future growth.

"On January 29, 1919, at a conference held at the Executive Mansion between the Governor of New Jersey and myself, the members of the Bi-State Commission and the leaders of the Legislature, the matter of the policy to be pursued by both States was discussed and the form of a treaty or compact between the two States was taken up and the first draft presented for consideration. At this conference, it was agreed that a commission from each State, representing the Legislature, should be appointed to assist the Port and Harbor Development Commission in revising the draft of the compact so that it might be presented in complementary form to the Legislatures of both States. I appointed such a commission under resolution of the Legislature, and the Governor of New Jersey appointed a like commission. The two Commissions have, I understand, been at work since January 19, 1919, and the compact accompanying the report of the Port and Harbor Development Commission is in the form agreed upon between the two legislative commissions. I am advised that a bill authorizing the signing of the compact was introduced at Trenton on Monday night and that a similar bill was introduced in the Senate and Assembly of this State March 23. I am advised also that legislation authorizing the Governors of the two States to appoint the commissioners provided for in the compact is to be introduced in the Legislatures of both States.

"The physical plans for the development of the port will be presented, I am informed by the Commission, in July. The compact as now drawn, however, provides that the powers of the Port Authority are not to be exercised until such a comprehensive plan has been approved by both States and by the municipality affected, and the municipalities within the Port District, especially the City of New York, are left free to proceed with the development of port and terminal facilities of their own.

"Article IX provides that, 'Nothing contained in this agreement shall impair the powers of any municipality to develop or improve Port and Terminal facilities;' and Article X, relating to the adoption of the comprehensive plan, provides that, 'No city within the Port District shall be bound by the comprehensive plan unless and until it has approved of the same,' and even after the adoption of the plan, no modification thereof can be made except with the approval of the municipality directly affected. The compact also provides (Articles IV and XXII) that the Board of Estimate and Apportionment of the City of New York shall select for appointment two of the three commissioners from the State of New York, who must be resident voters of the City of New York. Other articles in the proposed compact safeguard the municipalities' waterfront properties.

"When this matter was under consideration last year, a year's delay was asked on behalf of the State of New York in order that the matter might be further considered. The further consideration has now been had, and good faith with the State of New Jersey, which has postponed its own plans pending the consideration of the questions of policy involved in the compact, requires that the State of New York shall take action upon this matter at this session. The matter of Port development is critical. It affects the housing problems; it affects the cost of living; it affects the cost of doing business within the Port of New York; business is leaving New York because of inadequate facilities, and rival ports are taking advantage of delays in the development of New York's plans in order to strengthen their own position. Our most active competitors in this direction are the cities of Baltimore, Philadelphia and New Orleans.

"Action upon this matter of important policy in dealing with one of the great assets of the State and the Nation is imperative. As pointed out by the Bi-State Commission in the report which I transmit herewith, the matter of determining the policy which shall be pursued by the two States is logically the first problem; the details of the physical plan can come later.

"I especially urge upon your Honorable Bodies that you give this matter your immediate consideration."

LEGISLATIVE ACTION

Shortly thereafter acts authorizing an appointment of commissioners so soon as the compact was approved by both States were introduced in the Legislatures of New York and New Jersey; a copy of the Walters-Adler Bill is annexed as Appendix I and a copy of the Allen Port Treaty Bill is annexed as Appendix J.

The bill of the New Jersey Legislature was passed by the Senate April 12, 1920, and by the Assembly on April 15, 1920.

The members of the Board of Estimate and Apportionment having requested a hearing before the Senate Committee on Judiciary, such a hearing was held April 20, 1920. At this hearing counsel for the Commission attended, and representatives of the Chamber of Commerce, Merchants' Association, Citizens' Union, City Club, Hudson Valley Federated Chambers of Commerce and other organizations appeared in support of prompt action on the treaty. The Mayor, the Comptroller and the President of the Board of Aldermen of New York City, the Presidents of the Boroughs of Brooklyn, Queens and Richmond all appeared in opposition to the proposed compact, filing a memorandum, a copy of which appears as Appendix K.

On the same day His Excellency, Governor Edward I. Edwards, held a hearing on the bills passed by the Legislature of New Jersey at Trenton. At this hearing Hon. Thomas F. McCran, Attorney-General of the State of New Jersey, the three New Jersey members of this Commission and others appeared in support of the bills. Opposition came from representatives of Jersey City.

GOVERNOR EDWARDS' VETO MESSAGE

On April 21, 1920, Governor Edwards vetoed the bills in a message reading as follows:

"I have examined the proposed treaty with some care, and find these objections to it. First, the powers granted under Article VI cannot be exercised by the port authorities until the Legislatures of both States shall have approved of a comprehensive plan for the development of the port. It seems to me that if we postpone entering into the treaty until the comprehensive plan is prepared and submitted for consideration, greater and more speedy progress will be made. In other words, I think we should ascertain now what objections should appear or be made to the plan. They can be better dealt with, in my judgment, in the proposed treaty.

"Second, Article X provides that no city within the port district shall be bound by the comprehensive plan unless and until it has approved of the same. After the adoption of the plan or plans by the Legislatures of both States no modification in such plan or plans shall be made except by the port authority, with the approval of the municipality or municipalities directly affected by such modification.

"Just what is meant by the provision that no city within the port district shall be bound by the comprehensive plan I cannot determine, but it seems to me that such provision constitutes a weakness. Either the authority should be created with full and complete power in the premises organized and authorized to function as a vigorous and virile body, or not at all. This is another reason, it seems to me, why a plan should be submitted and determined upon before the treaty is entered into.

"I do not regard this veto as a final rejection of the policy of improving the Port of New York as a whole, rather as a means of securing real progress toward the final and complete end."

Endorsement by Political Parties in New York and New Jersey

At the unofficial convention of the Republican Party of the State of New York, held at Saratoga Springs, that party adopted on July 28, 1920, as part of its declaration of principles the following:

"A progressive plan of future improvement of harbor facilities must be adopted in co-operation with the State of New Jersey.

"We, therefore, favor a compact or agreement with our sister State which will provide for the creation of a port district and a port authority with adequate powers to develop this port comprehensively."

At the unofficial convention of the Democratic Party of the State of New York, held at Saratoga Springs, that party adopted on August 4, 1920, as part of its declaration of principles the following:

"We owe it to the nation to organize and develop the Port of New York. To that end we favor a compact or agreement with our sister State, New Jersey, which shall provide for the creation of a port district and a port authority with adequate powers to develop the port comprehensively, and with proper protection for New York City over the public ownership and development of its waterfront and commercial facilities."

The platform of the Republican Party of the State of New Jersey contained the following:

"New Jersey has been endowed by nature with great harbors and rivers, the development of which will not only add to our own growth and prosperity, but is demanded by the growing needs of the nation. Our State is part of the great Port of New York. We recognize the necessity of cooperation to properly develop and organize its facilities, and we favor a compact or agreement with our sister State which will provide for the creation of a Port District and a Port Authority with adequate powers to develop the same under comprehensive plans."

The platform of the Democratic Party of the State of New Jersey declared:

"To the end that adequate facilities for the mobilization of the products of our farms, mines, industries and commerce for interstate and foreign shipment may be provided, we pledge our party to the enactment of laws by which the several ports of New Jersey will be developed and brought to a state of high efficiency."

The Commission believes that the informed sentiment of both States now substantially supports the proposal to unite the two States by a compact or agreement with a port authority having adequate powers for the comprehensive development of the Port.

Proposed Compact and Reasons Therefor Briefly Stated

What It Does — The proposed compact, after the recitals (p. 3, lines 1 to 20; p. 4, lines 1 to 3) of the importance of the commerce of the Port, recognition of the existing fact that "the territory in and around the Port has become commercially one center or district," and that "a better co-ordination of the terminal, transportation and other facilities of commerce in, about and through the Port of New York will result in great economies, benefiting the Nation, as well as the States of New York and New Jersey," and that this development "will require the expenditure of large sums of money, and the cordial co-operation of the States of New York and New Jersey in the encouragement of the investment of capital, and in the formulation and execution of the necessary physical plans," and that such a result can best be accomplished through the co-operation of the two States by and through a joint or common agency, by Article I (lines 7 to 10, p. 4) pledges each State to "faithful co-operation in the future planning and development of the port," and by Article II creates a district to be known as the "Port of New York District."

By Article III there is created "The Port of New York Authority," a public corporate body with the powers and jurisdiction enumerated in the proposed compact and such other and additional powers as shall be conferred upon it by the Legislature of either State, concurred in by the Legislature of the other, or by act or acts of Congress.

By Article IV it is provided that the Port Authority shall consist of six commissioners, three resident voters from the State of New York, two of whom must be resident voters of the City of New York, and three resident voters from the State of New Jersey, two of whom shall be resident voters within the New Jersey section of the district, the New York members to be chosen by the State of New York and the New Jersey members by the State of New Jersey, in the manner and for the terms fixed by the Legislature of each State respectively.

Under Article VI the Port Authority is given full power and authority to purchase, construct, lease and/or operate any terminal or transportation facility within the district, to own and hold real and personal property, to borrow money and secure the same by bonds or mortgages on any property held or to be held by it. It is expressly provided *that none of the property of either State or of any county, city, borough, township or municipality shall be taken by the Port Authority without the authority or consent of such State, county, borough, township or municipality;* and it is expressly provided that the Port Treaty shall not affect the bonded indebtedness of any community, nor impair the provisions of law regulating the control of the revenues derived from municipal property. The same article provides that the Port Authority, as has already been indicated, shall not exercise any of its powers "until the Legislatures of both States shall have approved of a comprehensive plan for the development of the Port as hereinafter provided."

By Article VII the Port Authority is precluded from pledging the credit of either State, except by and with the authority of the Legislature thereof.

By Article VIII the jurisdiction of the public service commission, the public utility commission or like body, within each State, over railroads, transportation, terminal and other facilities is preserved, even if such railroad, transportation or terminal facility is owned or operated by the Port Authority.

Article X provides that the Legislatures of the two States "will adopt a plan or plans for the comprehensive development of the port of New York" either prior to the signing of the compact, or thereafter, as soon as may be practicable.

By Article XV the pledge of each State to the support of the Port Authority is limited to $100,000.

By Article XVI it is provided that no action of the Port Authority "shall be binding unless taken at a meeting at which at least two members from each State are present and unless four votes are cast therefor, two from each State." Article XVI further provides that "Each State reserves the right hereafter to provide by law for the exercise of a veto power by the Governor thereof over any action of any commisioner appointed therefrom."

Article XVIII provides that the Port Authority may, when concurred in or authorized by the Legislatures of both States, make suitable rules or regulations not inconsistent with the Constitution of the United

States or of either State and subject to the power of Congress over interstate commerce.

Limitations Upon Port Authority — From the foregoing summary it will be clear that the Port Authority cannot take over the property of any municipality without its consent, and that the franchise-granting power and the control over the streets of any city remain intact. The Port Authority, therefore, is not a supervening agency but is an agency for co-operation of all the municipalities within the district in both states. Unlike the Port Authority at London, at Liverpool, at Montreal or at New Orleans, it derives its greatest power not through the taking away of the initiative and independence of the various municipalities within the district, but through its capacity to aid those municipalities in working toward such a comprehensive organization of the Port as will be of advantage to all.

Borrowing Capacity of Port Authority — Public attention has already been drawn to the fact that neither State, nor any city within the Port District, is legally constituted to borrow the vast sums of money necessary for a comprehensive scheme of port development. Assuming that port facilities within the Port are self-supporting enterprises, returning large profits and amortizing themselves within a reasonable period, then without the creation of an agency of this kind, the self-supporting character of the enterprise will not exempt it from the debt limitation until the fact is demonstrated by actual operation. The Port Authority, however, upon the merits of any given development, may float its own bonds, backed by the assurance that it is a part of the great development of the Port. *The Port Authority can become the co-operative agency of any municipality, which, conditioning its grant of privileges upon the ultimate vesting of title to the property in the municipality, may hasten its own development through the assistance of the Port Authority.*

No Limitation Upon Freedom or Initiative of Any Municipality in Proposed Compact — Provided that any development is in conformity with the comprehensive plan, any municipality may go forward, as, indeed, may any private enterprise, to the full extent of its capacity.

Port of New York One Port — The Interstate Commerce Commission held, upon the argument of the State of New York in the New York Harbor Case, that "Historically, geographically and commercially New York and the industrial districts in the northern part of the State of New Jersey constitute a single community." This is the legal basis for maintaining the present rate zone. (See page 41, Chapter 1, Part II, "History and Purposes of the Commission.")

Dependence of Problem of Terminal Markets Upon Solution of Larger Terminal Problem — The dependence of the problem of terminal markets upon a solution of the larger terminal problem is set forth in Chapter 20 on " Markets and Food Distribution."

For other reasons leading to the Commission's conclusions, see Chapters 1–33.

Selection of Commissioners — The compact as drafted last year left to each State the method for naming commissioners, except that in the case of New York at least two of the three commissioners must be resident voters of the City of New York recommended by the board of estimate and apportionment of the City of New York and in the case of New Jersey they must be resident voters within the New Jersey section of the Port District. The legislation suggested last year by the Legislative Drafting Commission in New York is to be found in Appendix I, and that by the Legislative Drafting Commission in New Jersey is to be found in Appendix J.

ARGUMENTS AGAINST COMPACT ANSWERED

The main argument against the authorization of the compact heretofore advanced (see Governor Edwards' veto, page 58, and memorandum dated April 19, 1920, filed by the Board of Estimate and Apportionment of New York City with the Legislative Committee, Appendix K) was in substance that before the compact should be entered into the complete report of the Commission should be submitted to the Legislatures of both States. The answer to this argument has heretofore been made by the Commission in its reports and the briefs filed by its counsel.

Pursuant to the Act of 1917 creating the Commission, it was the intention of both States to avoid friction and come together on some kind of a joint policy "by legislative enactment or treaty or otherwise." The Commission was satisfied from its first year's study that such a joint policy was the only policy to be pursued by the two States, and that independent development of the Port of New York would be disastrous ultimately to both States — that any effort "to split the Port of New York" would injure the entire Port.

The Commission believed that somehow local prejudices must be overcome and that when the local communities saw the great advantages to be derived from such large co-operation, they would speedily join in the accomplishment of the results. Thus the Commission believed that the signing of the compact and the creation of a co-operative agency like the Port Authority would soon bring the communities into actual working harmony. It did not believe that it was necessary to lose a year or two until this entire report could be made available for public discussion. Now, however, that the report is available, the facts which led the Commission to recommend this joint policy seem to be compelling. No one who will take the pains to study the entire report can come to any other conclusion. The Port must be united and brought under a single co-operative control. Differences of opinion may come over details, but over the matter of general policy there can be no substantial difference.

The Legal Aspects of the Problem *

At the threshold of any study of the legal problems raised by the proposed unification of the Port we face the fact of dual political sovereignty. The Port lies in two States, each an independent sovereignty in its own land. Again, traffic between two States across boundary waters is interstate commerce. Neither one State nor the other can wholly regulate the Port. Yet starting with the truth enunciated by the Interstate Commerce Commission, that "historically, commercially, and industrially the cities of northern New Jersey within the metropolitan district constitute a part of New York,"[1] the problem presented to the Port Commission is, how shall this interstate relationship, now politically divided, be effectively united to promote the welfare of the two States and the Nation?

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*This portion of the report summarizes and brings down to date the Preliminary Report of the Counsel forming a part of the Progress Report of the Commission for 1919, Legislative Document No. 103; and also portions of an article in the Cornell Law Quarterly for May, 1920, entitled " New York Harbor Problem and Its Legal Aspects," by the counsel for the Commission.

HISTORICAL RELATIONS

A constructive solution of the legal questions involved must take full account of the historical relations of New York and New Jersey. See also Chapter I, "History and Purposes of the Commission."

A source of continual dispute in the early days of the two States lay in the controversy over title to the waters of New York Harbor.[2] On the one hand, New York by the terms of the grant from the Duke of York to Lord Berkeley and Sir George Carteret of the territory later constituting the State of New Jersey, laid claim to the waters of the Hudson River and New York Bay to high-water mark on the New Jersey shore, while New Jersey, threatened with unfriendly control of her wharves and shore improvements, contended that by the Revolution she had conquered from the Crown a sovereignty extending to the middle of the river. The decisions of the courts in analogous cases were hostile to New Jersey's stand.[3]

Various attempts to settle this boundary dispute by arbitration were unsuccessful, and litigation brought by New Jersey against New York also failed to terminate the controversy.[4] But in 1833, through the initiative of Governor Marcy of New York, three commissioners from each State were appointed, met, and negotiated a treaty, which was adopted by the two States and confirmed by act of Congress.[5] (See Chapter I, pp. 42, 43.)

Briefly, the treaty provided that the boundary between the two States should be the middle line of the Hudson River and the bay, New York retaining sovereignty over the islands. But to New York was given *exclusive jurisdiction* (as distinguished from *sovereignty*) over all the waters of the river and bay (within certain wide limits), New Jersey retaining only title to her lands under the river, jurisdiction of wharves, docks and improvements made on her shore, of all vessels aground on the shore or fastened to the docks, and of fishing rights in the westerly half of the river. Over the waters between Staten Island and New Jersey, the latter was given general jurisdiction similar to that of New York over the river and bay, and New York retained corresponding title to lands under water and jurisdiction over docks, boats and fisheries.

The peculiar distinction drawn in the treaty between bare sovereignty and jurisdictional control was fundamental. As we have seen, the commissioners of New York, which already was embarked upon its career of commerce, "deemed it indispensable that their great commercial emporium should have the exclusive control of the police on the surrounding waters, and full power to establish such quarantine regulations as should be found necessary."[6] Their intention has been continuously respected and enforced by the courts of both States and of the United States.[7]

The Commission having concluded that the structure of a Port Authority for the Port of New York should be built upon the firm foundation of the New Jersey-New York Treaty of 1834, it concluded, further, that in such an amendment of the treaty account should be taken of what is now known as the "Metropolitan District," and that the greater part of this industrial and economic group should be included in what, for convenience, may be called the Port District, and that over it should be a central administrative body, the Port Authority, created by the joint action of the two States.

COMMERCE AND NAVIGATION — THE FEDERAL POWER

By the Federal Constitution there is given to the legislative branch of the Federal Government plenary control over interstate commerce, and, as we shall see, this has been interpreted to include absolute control over all the instrumentalities necessarily involved in such commerce, which includes all navigable waters.[8] Such is the unique position occupied by the Port of New York, lying, as it does, midway between two States, that any traffic passing from one shore to the other is interstate commerce, and thus subject to the jurisdiction not only of New York and New Jersey within their respective territories, but also to the paramount authority of the United States. Herein, the unification of the Port involves problems which no other important American port would present.

The first of the great decisions interpreting the constitutional authority of the Federal Government to control interstate commerce, was brought forth by a controversy over traffic originating in the Port of New York. In 1798 Robert Livingston secured from the State of New York a monopoly for the operation of steamboats upon the waters of the State. Upon the basis of this monopoly the "Clermont" was constructed and put in operation upon the Hudson River between New York and Albany. Competitors were, for some time, subjected to the restraints of the monopoly, much to the indignation of New Jersey interests, who wished to establish a line from Philadelphia to New York, but whose entry upon New York waters was thus prevented, except by payment of a tax to the monopolists. It was not long, however, before a rival company established a line running from New York to Albany, without a license, and Livingston at once applied for an injunction. His application was granted by the New York State courts, but the United States Supreme Court, Chief Justice Marshall writing the opinion, in *Gibbons* v. *Ogden,*[9] declared that the Legislature of the State of New York *had no power to grant a monopoly upon navigable waters, and that since traffic between the two States constituted interstate commerce the power to regulate such commerce lay with Congress.*

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[1] New York Harbor Case, No. 8994, 47 I. C. C. 643, at 713.

[2] The history of the boundary dispute between the two states has been well told in two cases: Central R. R. of N. J. v. Jersey City, 70 N. J. L. 81 (1903); State v. Babcock, 30 N. J. L. 29 (1862). Judge Elmer, who wrote the decision in the latter case, was in fact one of the Commissioners who negotiated the Treaty of 1833-34.

[3] State v. Davis, 1 Dutcher (N. J.) 386 (1856), deciding adversely to New Jersey a claim, based upon the same grant, to the left (New Jersey) half of the Delaware River; Handley's Lessee v. Anthony, 5 Wheat. (U. S.) 374 (1820), in which the United States Supreme Court, ruling specifically upon the Ohio River, but speaking generally of all great streams, said: "When a great river is the boundary between two nations or states, if the original property is in neither, and there be no convention respecting it, each holds to the middle of the stream," but "when, as in this case, one state (Kentucky) is the original proprietor, and grants the territory on one side only, it retains the river within its own domain, and the newly created state (Indiana) extends to the river only."

[4] 3 Pet. (U. S.) 461 (1830); 5 *id.* 283 (1831); 6 *id.* 323 (1832); see summary of bill in 108 U. S. 406-410 (1882).

[5] Ch. 8, Laws of New York, 1834; Laws of New Jersey, 1833-34, p. 118.

[6] State v. Babcock, 30 N. J. L. 29, 33, 34 (1862).

[7] State v. Babcock, *supra*, note 6, holding that no indictment would lie in New Jersey for a nuisance below low water mark on the New Jersey shore, since the exclusive jurisdiction thereto was in New York. Central R. R. of N. J. v. Jersey City, 70 N. J. L. 8 (1903); aff'd in 209 U. S. 472 (1907); Ferguson v. Ross, 126 N. Y. 459 (1891).

[8] See opinion of Bradley, J., in Stockton v. B. B. & N. R. R. Co., 32 Fed. 9, 20, 21 (1887), and cases *infra*, page 14, notes 10 to 15.

From this decision as a starting point, the courts have established by a long line of cases that Congress has, *so far as it chooses to exercise the power,* exclusive control over every means of communication which forms "a *connecting* link * * * which will carry commerce from and to foreign countries and between the states."[10] "Commerce includes navigation. The power to regulate commerce comprehends the control for that purpose, and to the extent necessary, of all the navigable waters of the United States which are accessible from a State other than those in which they lie. For this purpose they are the public property of the nation, and subject to all the requisite legislation by Congress."

*, * *

"It is for Congress to determine when its full power shall be brought into activity, and as to the regulations and sanctions which shall be provided."[11] Congress may in its discretion authorize or forbid any project to be undertaken, or condemn one already completed, by private individuals or by the States, which affects interstate commerce. It matters not whether the State has authorized a project which Congress deems to be obstructive of a navigable stream,[12] or whether Congress has authorized a project which the State would forbid.[13] "The power of control over such (navigable) waters necessarily includes the power of deciding what structures are impediments to commerce; and, by an unbroken line of decisions, it is settled that the paramount authority regulating bridges that affect the navigation of the navigable waters of the United States is in Congress.

"So long as this authority lies dormant, the states may authorize the erection of bridges over navigable waters within their limits, which may to some extent obstruct navigation, or, *by concurrent action,* may bridge the waters lying between them; but, so soon as Congress intervenes and exercises its power of regulation, what has been done by the state authority must give way to the paramount authority of Congress. The power of the state ends where that of the nation begins."[14] Indeed, such is the Federal authority over interstate trade that Congress (or the Secretary of War, to whom it has delegated power to determine whether, and when, a given bridge constitutes an obstruction to navigation) may require the removal or alteration of any structures on, over, or under navigable waters, even when erected pursuant to a congressional grant, irrespective of any express reservation to Congress of the right of revocation or amendment.[15]

COMMERCE AND NAVIGATION — THE STATE POWER

Permissive or restrictive, as the case may be, the power of Congress over the instrumentalities of interstate traffic is exclusive, *when in a specific case it has been exercised.*[16] But this latter limitation, coupled with the broad police power of the State and its control of *intrastate* commerce, has left to New York and New Jersey a broad field within which they may act without express Federal consent. It is hoped, of course, by securing congressional approval of any plan which may be adopted, to avoid future conflict with the Federal authority over interstate unification and control of the Port. But for the present the States *may* act alone.

Under our system of dual political sovereignty the powers of government may be divided into four classes; namely, those belonging exclusively to the States, those reserved exclusively to the Nation, those which both may exercise concurrently and independently, and those which may be exercised by the States, but only until Congress shall see fit to act upon the subject.[17] With the second class we have little concern, for the cases which fall within it are limited to those "where the subject is national in its character, *and admits and requires uniformity of regulation, affecting alike all the States,* such as transportation between the States, including the importation of goods from one State to another" (or the taxation by a State, either openly or by subterfuge, of immigration):[18] "The absence of any law of Congress upon the subject is equivalent to its declaration that commerce in that matter shall be free."[19] From such subjects the States are barred from *any* action whatsoever.

Nor apparently will the third class affect our study. But the adjudicated cases involving the first and last classes of powers are most pertinent in determining what authority remains to the States to carry out a plan for port development.

It is, of course, unnecessary to recall that, as to all matters not expressly delegated to the Federal Government, the power of the State remains supreme, and it has been explicitly declared by the Supreme Court of the United States, most jealous guardian of Federal authority, that "it is competent for a State to govern its internal commerce, to provide local improvements, to create and regulate local facilities, to adopt pro-

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9 Wheat. (U. S.) 1 (1824).

[10] From the opinion of Chester, J., in People v. Hudson R. C. R. Corporation 104 Misc. (N. Y.) 19, 28 (1918); aff'd by the Court of Appeals, 228 N. Y. 203, *infra,* note 13.

[11] Gilman v. Philadelphia, 3 Wallace (U. S.) 713, 724–5 (1865).

[12] Union Bridge Co. v. U. S., 204 U. S. 364, 388, 400 (1906); Monongahela Bridge Co. v. United States, 216 U. S. 177, 193 (1909).

[13] This principle has been reiterated recently by the New York Court of Appeals in the case of People v. Hudson R. C. R. R. Corp., 228 N. Y. 203, opinion by Elkus, J.; writ of error denied by U. S. Supr. Ct. Oct. 11, 1920. See also Stockton v. Baltimore & N. Y. R. R. Co., 32 Fed. 9 (1887).

[14] Decker v. Baltimore & N. Y. R. R. Co., 30 Fed. 723 (1880), For supporting authorities, see notes 9 to 16 incl.

[15] Newport and C. Bridge Co. v. United States, 105 U. S. 470, 481 (1881); Hannibal Bridge Co. v. United States, 221 U. S. 194, 207 (1910); Louisville Bridge Co. v. United States, 242 U. S. 409 (1916)

[16] Erie R. R. Co. v. State of N. Y., 233 U. S. 671, 681 (1913); and cases *supra,* notes 9 to 15. For late cases on this congressional power see, in addition, U. S. v. Hill, 248 U. S. 420 (1918); Merchants Exchange of St. Louis v. State of Missouri, 218 U. S. 365 (1918).

[17] *Ex parte* McNiel, 13 Wall. (U. S.) 236, 240 (1871).

[18] Passenger Cases, 7 Howard (U. S.) 283 (1849), where a direct tax upon each passenger landing at the port of New York was attempted to be levied by the state and the statute was held unconstitutional. Henderson v. Mayor of New York, 92 U. S. 259 (1875), where the same tax was attempted by indirection, and the statute held invalid; but it was recognized that the state might require a sworn statement of certain facts concerning such passengers.

[19] Southern Pacific Co. v. Jensen, 244 U. S. 205, 217 (1916).

tective measures of a reasonable character in the interest of the health, safety, morals, and welfare of its people, *although interstate commerce may incidentally or indirectly be involved.* Our system of government is a practical adjustment by which the National authority as conferred by the Constitution is maintained in its full scope without unnecessary loss of local efficiency. Where the subject is peculiarly one of local concern, and from its nature belongs to the class with which the State appropriately deals in making reasonable provision for local needs, it cannot be regarded as left to the unrestrained will of individuals because Congress has not acted, although it may have such a relation to interstate commerce as to be within the reach of the Federal power."[20]

The reason for this dual control is evident. Freedom of commerce between the States is so essential that there must exist a general power having as its charge the interest of the Nation as a whole, to curb the State if it seeks to abuse its sovereign authority; but therein the Federal function is guardian only. The development of local resources and the control of local facilities is primarily a matter for regulation by the State. Each project involves difficulties peculiar to itself, capable of solution by itself alone. The State is the first to appreciate its importance, is more deeply concerned in its development, and can better undertake its managment than could a government at a distance.[21] Obviously there is no conflict with the spirit of the constitutional provision giving to Congress plenary control of interstate commerce. Says Mr. Justice Field, speaking for the Supreme Court of the United States: "The control of Congress over them (harbors, bays, and navigable rivers) is to insure freedom in their navigation, so far as that is essential to the exercise of its commercial power. *Such freedom is not encroached upon by the removal of obstructions to their navigability or by other legitimate improvement.* The states have as full control over their purely internal commerce as Congress has over commerce among the several states and with foreign nations; and to promote the growth of that internal commerce and insure its safety they have an undoubted right to remove obstructions from their harbors and rivers, deepen their channels, and improve them generally, *if they do not impair their free navigation as permitted under the laws of the United States, or defeat any system for the improvement of their navigation provided by the general government. Legislation of the States for the purposes and within the limits mentioned do not infringe upon the commercial power of Congress."* * * * And he explains "some of the divergence of views upon this question among former judges." They "have arisen from not always bearing in mind the distinction *between commerce as strictly defined, and its local aids or instruments, or measures taken for its improvement.* Commerce with foreign countries and among the States, strictly considered, consists in intercourse and traffic, including in these terms navigation and the transportation and transit of persons and property, as well as the purchase, sale and exchange of commodities. For the regulation of commerce as thus defined there can be only one system of rules applicable alike to the whole country; and the authority which can act for the whole country can alone adopt such a system. Action upon it by separate States is not, therefore, permissible. Language affirming the exclusiveness of the grant of power over commerce as thus defined may not be inaccurate, *when it would be so if applied to legislation upon subjects which are merely auxiliary to commerce."*[22]

Accordingly, where the propriety of specific projects has been in question, the courts have held that a State (or its political subdivisions and delegates) may authorize the erection of a bridge over a navigable stream, even though to some extent it impedes navigation,[23] or the construction of dams and locks in such a stream.[24] It may regulate pilotage.[25] It may erect wharves.[26] It may maintain and regulate ferries,[27] always assuming that such management has not been taken from its hands by action of the Federal Government.[28] Directly in line with the New York problem, it may provide a comprehensive plan for the improvement of harbors, bays, and rivers in all their branches;[29] and for the use of these improvements it may make a reasonable charge. Such improvements, while perhaps made primarily to advance intrastate commerce, benefit interstate trade also, and such a charge may be made, not as a discriminatory restraint upon such interstate trade,[30] but to reimburse the State or municipality for the cost of providing and maintaining artificial conveniences for the promotion of commerce.[31]

It may in addition be noted at this point that the power of Congress to control navigable streams in the interest of commerce does not convey to the United States the title to the soil under such streams, although it gives control of the soil so far as the same is necessary for commercial purposes. But title to the soil remains in the States and subject to their disposition.[32]

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[20] Minnesota Rate Cases, 230 U. S. 352, 402 (1912). For a long series of cases in which the exercise of state power has been sustained, where Congress has acted only generally, see the dissenting opinions in Southern Pacific Co. v. Jensen, *supra*, note 19, at p. 244; and New York Central Railroad Co. v. Winfield, 244 U. S. 147, 156 (1916).

[21] Escanaba Co. v. Chicago, 107 U. S. 678, 683 (1882); Cardwell v. American River Bridge Co., 113 U. S. 205, 208 (1884).

[22] County of Mobile v. Kimball, 102 U. S. 691, 699 (1880).

[23] Passaic Bridge Cases, 3 Wall. (U. S.) 782, 793 (1835); Hamilton v. Vicksburg, S. & P. R. R. Co., 119 U. S. 280 (1836); Escanaba Co. v. Chicago, 107 U. S. 678 (1882); Cardwell v. Amer. River Bridge Co., 113 U. S. 205; People v. International Bridge Co., 223 N. Y. 137 (1918).

[24] Huse v. Glover, 119 U. S. 543 (1886); Manigault v. Springs, 199 U. S. 473 (1904).

[25] Olsen v. Smith, 195 U. S. 332 (1903); Cooley v. Board of Wardens of Port of Philadelphia, 12 Howard (U. S.) 299 (1851); *Ex parte* McNeil, 13 Wall. (U. S.) 236 (1871).

[26] Packet Co. v. St. Louis, 100 U. S. 423 (1879); Guy v. Baltimore, 100 U. S. 434 (1879); Transportation Co. v. Parkersburg, 107 U. S. 691, 696, 698 (1882); Packet Co. v. Keokuk, 95 U. S. 80 (1877).

[27] Port Richmond Ferry v. Hudson County, 234 U. S. 317 (1913). This case involved the regulation of a ferry running between New York and New Jersey. While only regulation by New York was in question, it was clearly recognized by Mr. Justice Hughes, writing for the Supreme Court, that it would be possible for New Jersey also to establish conflicting regulations and that within the territory of each state its own regulations must be supreme, irrespective of the result upon the business of the ferry. Wilmington Transportation Co. v. Railroad Commission of California, 236 U. S. 151 (1914).

[28] New York Central R. R. v. Hudson County, 227 U. S. 248 (1912); U. S. v. Baltimore & Ohio Railroad Co., 231 U. S. 274, 288 (1915); Sault Ste. Marie v. International Transit Co., 234 U. S. 333 (1915); St. Clair County v. Interstate Sand & Car Transfer Co., 192 U. S. 454 (1903). These cases involved the regulation of ferries used in connection with railroad lines either to transport passengers or for lighterage or used in international transportation. Held, that Congress had already provided through the Interstate Commerce Act for such regulation.

[29] County of Mobile v. Kimball, 102 U. S. 691 (1880); Huse v. Glover, 119 U. S. 543 (1886); Sands v. Manistee River Improvement Co., 123 U. S. 288 (1887).

[30] Example of such a discriminatory charge which is invalid is found in Guy v. Baltimore, 100 U. S. 434 (1879), where vessels owned by Maryland residents were admitted to the use of the public wharves at Baltimore free of charge, while vessels of non-residents were required to pay a fee for the use of the docks.

[31] Packet Co. v. St. Louis, 100 U. S. 423 (1879); Huse v. Glover, 119 U. S. 543 (1886); Packet Co. v. Keokuk, 95 U. S. 80 (1877); Transportation Co. v. Parkersburg, 107 U. S. 691 (1882); Sands v. Manistee River Improvement Co., 123 U. S. 288 (1887).

The summary of this legal situation given by Gould in his Laws of Waters is excellent:[33]

"Under the Constitution of the United States a state has the right if its legislation does not conflict with the action of Congress upon the same subject, to authorize bridges and dams across the navigable waters within its limits; to license wharves, piers and docks intruding upon such waters; to establish harbor lines to which wharves may be extended; to prescribe the places and manner in which vessels may lie in a harbor; what lights they are to carry at night, or what course they shall pursue in navigating a river; to pass reasonable quarantine and inspection laws, and pilotage, or port regulations; to regulate harbor beacons, buoys, salvage, and similar matters of a local and limited nature; to improve the navigability of its waters, and to authorize the collection of tolls in consideration of such improvements."[34]

So far as the Port of New York is concerned, a bi-State Port Authority may undertake the unification of the Port, the co-ordination of its activities, the extension and enlargement of its facilities, and the supervision and direction of the growth which would be sure to follow correction of the waste and inefficiency which now exists.

PROPERTY RIGHTS

The States of New York and New Jersey have jurisdiction, then (subject always to the supervising power of Congress), over the Port of New York. A more practical question remains. Have they any power to provide the manifold instrumentalities which today are the indispensable adjuncts of a great and busy port, or to take over or control those instrumentalities already in existence? If so, upon what conditions; subject to what limitations? The question of the creation of new agencies of commerce is better considered under a subsequent division of the subject. For the present we are concerned with the conflict between the power of the Port Authority and existing property rights, or, to narrow the inquiry to the question which most pressingly confronts us, with the power of the State to regulate the waterfront property along the harbor.

TITLE TO SHORE FRONT PROPERTY UPON NAVIGABLE RIVERS

Outlining briefly the scope of this subject, the broad common law rule is that title to the shore of and to lands under a navigable stream or tidewater rests in the sovereign as trustee for the public, and that not only is a grant of such water land construed most strongly against the grantee, but from every such grant "there is impliedly reserved the right of navigation, *and, as a necessary part of so important a subject, the right to improve navigation for the benefit of commerce.*"[35] Moreover, such a grant is impressed not only with this implied trust from the State, but it is further subject to the paramount authority of Congress, heretofore considered, to regulate navigation and its agencies. For an admirable presentation of these rules, together with their application to existing facts, we refer to two cases of recent years. *Lewis Blue Point Oyster Cultivation Company* v. *Briggs*[36] and *United States* v. *Chandler-Dunbar Water Power Company*,[37] in both of which individuals who contended that they had acquired rights which could be taken only for just compensation, were held to have prosecuted their enterprises, in the one case the establishment of an oyster bed, in the other development of the water power capacity of St. Mary's River, subject to this paramount public interest, and accordingly the dredging of a channel across the oyster beds to aid navigation, and the diversion of the river to a ship canal, was held in the respective cases not to constitute the taking of private property for a public use.

But an examination of the many decisions passing upon the subject will show that, despite this paramount public interest, certain property rights along and over navigable streams can and have been granted; that while such a grant is of a *franchise* and not of *title to land,* it is nevertheless property for which upon seizure compensation must be made; and that the public right impliedly reserved from the grant is one of *regulation* and not of *sequestration.* The two cases last discussed are exceptions to the general rule upon the *facts,* and their principle is broad and sound. They held that not even a franchise had been granted. The search will further show that the United States Supreme Court, in dealing with the rights of riparian owners upon a navigable stream, is governed by the law of the State in which the stream is situated,[38] that the extent of the authority conferred upon a city by its charter, the construction of the charter, and the validity, scope and effect of ordinances and proceedings thereunder and rights of parties thereto under State law, are regarded by the United States Supreme Court as *matters of State law* as to which the decisions of the State courts are controlling,[39] and that these rights of riparian grantees are of three classes, according as the grant is in New Jersey, in New York, or in certain portions of the City of New York.

(a) *New Jersey*

The common-law rule in New Jersey is that which prevailed in England and was adopted from that land by the colonies. "The title of owners of land bounded by the sea, or by navigable rivers where the tide ebbs and flows, extends to ordinary high water mark only. The title to the *shore* between ordinary high and low water mark, as well as the title to the soil under the water, belongs, *prima facie,* to the sovereign."[40] But the courts of that State have admitted a modification of the rule, most important in its effect upon the port development problem. Under this local rule each riparian owner possesses, as an incident to his ownership of the upland, a right to "wharf out," *i. e.*, the right to build down to low water mark, and to use in conjunction with his upland property and to connect it with navigable water, wharves and similar structures.[41] Prior to the exercise of this right, it is a mere license, revocable at the will of the Legislature, and the State may convey such rights, for public or private use, without compensation to the adjoining riparian owner,[42] but immediately upon the improvement or reclamation by the upland owner, the license becomes irrevocable and the wharves become private property, with the usual rights and privileges which inhere therein.[41]

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[32] Arkansas v. Tennessee, 246 U. S. 158 (1917). See also Arkansas v. Mississipp 250 U. S. 39 (1919).

[33] Third edition, sec. 3. See also enumeration in Gibbons v. Ogden, 9 Wheat (U. S.) 1 (1824). Minnesota Rate Case, 230 U. S. 352 (1912), at pp. 403 and 411.

[34] For cases supporting this classification, see *supra*, page 15, note 20. A late case upholding the state power is Matter of Pennsylvania Gas Co. v. Public Service Commission, 2nd District, 225 N. Y. 397 (1919), involving state control of interstate gas pipe lines.

[35] Lewis Blue Point Oyster Cultivation Co. v. Briggs, 198 N. Y. 287 (1910); affd., 229 U. S. 82 (1912).

[36] *Supra*, note 35.

[37] 229 U. S. 53 (1912).

[38] Weems Steamboat Co. v. People's Steamboat Co., 214 U. S. 345 (1908); St. Anthony Falls Water Power Co. v. St. Paul Water Commissioners, 168 U. S. 349 (1897).

[39] St. Louis & Kansas City Land Co. v. Kansas City, 241 U. S. 419 (1915).

[40] Gough v. Bell, 22 N. J. L. 441, 455 (1852). See also American Dock & Improvement Co. v. Trustees, 39 N. J. Eq. 409, 411 (1885).

Occasionally a limitation has been imposed; as, for example, in the cases where its charter gave a corporation the right only to build wharves, and not to transfer the privilege to others, and the court held that the grant of such a valuable right could not be *presumed* in the absence of direct and explicit terms.[43] But cases in this class are so few that they would little relieve the Port Authority where it should be found advisable to alter existing waterfront conditions. Only a complete survey, therefore, of all the grants of land on the New Jersey shore will establish to what extent control of the waterfront has passed from the hands of the State to private owners.

(*b*) *New York*

The doctrines of riparian ownership in New York lead to a result similar to that reached by the New Jersey courts, although the legal principles stated are somewhat different.

There are two classes of riparian interests which have been held to vest a property right in the holder thereof, as distinguished from a mere revocable license. In one of these classes the basis of the right is an express grant from the Legislature or other sovereign power to erect wharves or similar structures upon water land; in the other, it rests upon a doctrine, announced by the New York courts as a modification of the strict common-law rule, that every riparian owner has a right of access to the navigable water fronting his premises and to make practicable this right of access by means of piers.

A recent and exhaustive consideration of the first class is found in the case of *First Construction Co.* v. *State of New York.*[44] The grant, which dated back to colonial days, was of the right "to erect, construct, build and maintain a seawall or breakwater pier, docks, wharves, bulkheads, piers, and warehouses and a basin for commercial purposes on the lands under water in front of their premises and to fill in the same." It was held that this "is not a grant of a fee to such land; but is a permit * * *"; that (and here the Court of Appeals differed from the New Jersey courts) it was not "a mere license, revocable by the state at will and without payment of compensation," but "the privilege amounts to more than this and * * * an act granting the right to fill in lands under water, and thereby acquire title to the same, gives an inchoate, vested interest in the lands described which is a property right and of which, unless lost or forfeited in some way, the grantee cannot be deprived without compensation."[45] Judge Hiscock, writing the opinion, says further[46] "Grants like the one under consideration are not nude pacts, but rest upon obligations expressly or impliedly assumed to carry on the undertaking to which they relate. * * * They are made and received with the understanding that the recipient is protected by a contractual right from the moment the grant is accepted and during the course of performance as contemplated, as well as after that performance." Under the principles established by the United States Supreme Court this privilege amounts to a franchise (wherefore it was error to award damages based on the theory that complainant had title to the land), and like all franchises "is subject to defeasance or forfeiture by failure to exercise it, or by subsequent abandonment after it has been exercised" and if "no time is prescribed, the franchise must be exercised within a reasonable time."[47]

Following this decision, the Attorney-General procured an amendment to the Public Lands Law of the State[48] which imposes the duty upon the Secretary of State and the State Engineer and Surveyor to search out defaults of compliance with such grants, and imposes upon the Attorney-General the duty to bring appropriate action to annul such grants in which there is default.

Typical of the second class is *Town of Brookhaven* v. *Smith.*[49] Brookhaven held title to water lands in fee under a grant from the Crown. Defendant, a riparian owner, had erected a pier extending one hundred and fifty feet out into the bay and used it to reach pleasure boats. It was conceded that the structure was proper enough for the purpose, and was no appropriation of the lands under water except as the soil was used to hold the piles. The court stated that "this court has, in several instances, expressed, and quite deliberately, a rule of interpretation, which gives a practical value or utility, to the riparian owner's conceded right of access to the navigable part of the body of water in front of his uplands. I cannot agree that, in construing these grants of lands under the waters of the bay (to the town), we are bound to hold with the doctrine of the common law of England * * * Different political and geographical conditions may justify modifications and whether common-law rules will be followed strictly by our courts will, necessarily, where no vested rights are actually concerned, depend upon the extent to which they are reasonable and in accord with our public policy and sentiment." "It is a matter of general observation," said Judge Gray, "of which judicial notice may wisely be taken, that riparian owners everywhere upon the numerous navigable bodies of waters within the territorial limits of this State have made their easement or right of access practical and available by the construction of docks, piers or wharfs, and have done so without interference by the State, where superior public rights have not been obstructed. These interests must be very large and if we shall hold with the English common-law doctrine, that they are purprestures, or unlawful encroachments upon the proprietary rights of the State, as would follow, if we affirm this judgment, and that they are removable at pleasure, it would result in causing a very grave loss. Such a decision would be to ignore what has been believed to be a common right, within numerous adjudications of our courts."

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[41] The leading case is Gough v. Bell, *supra*, note 40, holding that when this right had been exercised so that "the land was reclaimed, or the wharf erected by the tacit or express consent of the legislature, it became private property, and divested of its public character. And the owner has the same absolute dominion over it, the same exclusive right of enjoyment in it, that he has in and over other private property." Applying this same rule are O'Neill v. Annett, 27 N. J. L. 290, 293 (1858); American Dock & Improvement Co. v. Trustees, *supra*, note 40; Hoboken Land & Improvement Co. v. Mayor of Hoboken, 36 N. J. L. 540 (1873); Palen v. Ocean City, 64 N. J. L. 669 (1900).

[42] N. Y., Lake Erie & Western R. R. Co. v. Yard, 43 N. J. L. 632 (1881); Stevens v. P. & N. R. R. Co., 34 N. J. L. 532 (1870); Marcus Sayre v. Newark, 60 N. J. Eq. 361 (1900).

[43] Morris Canal & Banking Co. v. Central Railroad Co., 16 N. J. Eq. 419 (1863); Newark Aqueduct Board v. Passaic, 45 N. J. Eq. 393 (1889).

[44] 221 N. Y. 295 (1917). See also the report of the referee in this case, ex-Judge Haight, vol. 106, 1916, Court of Appeals Cases, Bar Association Cases on Appeal, p. 98 *et seq.*

[45] P. 316.

[46] Pp. 317, 318.

[47] N. Y. Electric Lines Co. v. Empire City Subway Co., 235 U. S. 179, 194, 195 (1914), quoted by Judge Hiscock in the First Construction Co. case, 221 N. Y. 295 (1917), at p. 317.

[48] Sec. 77, Ch. 308, Laws 1917.

[49] 188 N. Y. 74, 78, 80, 87 (1907).

"The right of access is conceded to be a valuable one and, unless the foreshore has been appropriated by the general government to some superior, and lawful, public use, as for example, by a grant to a municipality, or for navigation purposes, it is entitled to the protection of the law. * * * The courts of this State have been careful, in all cases, while sustaining the rights of the riparian owner, to declare them subordinate to the exercise of the power of the Legislature, or of the Congress, for the improvement of navigation, or for the regulation of commerce. They must yield to the demands of public commercial necessities." But in general, "when the use of a thing is granted, everything is granted by which the grantee may enjoy such use. By analogy, we may reason that the riparian owner's right of access to the navigable waters in front of his upland comprehends, necessarily and justly, whatever is needed for the complete and innocent enjoyment of that right."

Accordingly, as in the case of New Jersey, a most careful survey of the titles to waterfront property vested in private individuals is necessary before we can determine the extent to which the State may take over waterfront property without making compensation.

(c) *The City of New York*

The rights of riparian owners within the City of New York derived from improvements made by them over tidewater lands are similar to those of waterfront owners within New York State but outside of the city. Because, however, of the peculiar interest of the city in such lands, separate consideration of these rights has seemed necessary, the reason therefor being that the city, and not the State, is the owner of the fee of these lands.

By the Dongan charter in 1686 and the Montgomerie charter in 1730, the City of New York, then restricted to the Island of Manhattan, was by the Crown given title to the foreshore and to a strip of land 400 feet wide extending out from low water mark, on the lower part of the island, together with certain connected rights, expressly including the rights of *dockage and wharfage and of ferriage.* In 1798, 1806, and 1807 these rights were confirmed and extended by the State Legislature.[50]

On various occasions the State has attempted to deny that title to the lands was granted to the city, but in every instance the courts have rejected the State's contention, and have held that as to these lands the city holds title and stands with the State, as trustee for the public, with all of the State's power to convey the lands to individuals to secure the public benefit; and that such grants are no more to be construed strictly against the grantee than would be those from the State in similar instances, since they are made for a valuable and adequate consideration.[51]

The subject was thoroughly considered by the Court of Appeals in *Langdon* v. *Mayor,*[52] where Earl, J., writing the opinion for the court, held: "taking the language of the charters and grants, the course of legislation and all the statutes in *pari materia,* the situation of the lands granted and the use to which many portions of them had, with the knowledge and consent of the Legislature, been from time to time devoted, it is very clear that the lands under water around the city were conveyed to it in fee, to enable it to fill them up as the interest of the city might require, and to regulate and control the wharves and wharfage." Thus, having the power and the title, the city could transfer and convey it to individuals. "Having the power to extend the *ripa* around the city, and thus make dry land, it could authorize any individual to do it. Whatever wharves and docks it could build, it could authorize individuals to build, and whatever wharfage it could take, it could authorize individuals to take." Accordingly, it was held that the plaintiffs could not be deprived of their rights, even when the property was needed for a public use, except under the right of eminent domain, and upon making compensation; that the Legislature could not authorize a destruction or impairment of these property rights without compensation. In the course of the opinion Judge Earl said that the common law rule requiring both that "all grants by the sovereign of exclusive privileges and franchises, and all gratuitous grants of land should be strictly construed again the grantee; * * * should not be applied to grants of land made for a valuable and adequate consideration paid or agreed to be paid by the grantee." He said: "The Federal government annually makes numerous grants of lands for value paid, and so do some of the States and cities, and it would be quite absurd and perhaps alarming to apply to such grants, usually made by intelligent public officers, with deliberation, in language carefully chosen, under the advice of counsel, the strict rule of construction which at common law was applied to the grants of the English sovereigns." In discussing the power of the city, Judge Earl said: "It is, however, further contended by the appellants that the city did not have the power to grant the permanent easement claimed by the plaintiff; that the Legislature had not conferred upon it the power, by creating an easement over land yet covered by water, forever to preclude either the city or State from exercising that public dominion over navigable waters which was necessary to enable it to discharge the trust of furnishing to the commerce of a great seaport those accommodations which, in the judgment of the city or the State, such commerce may, from time to time, require; that even if the State could delegate the power to the city to grant such an easement, applying the strict rule of interpretation which they invoke for the construction of public grants, there is no language in the act of April 3, 1807, from which any power to create such an easement can be inferred; that the control over the waterfront of the city is a public right pertaining to the sovereignty of the State, and that any surrender of it, even to a subordinate governmental agency, such as a municipal corporation, can be proved only by the most indubitable evidence; and that the corporate authorities of the city at any particular time could not bind their successors and prevent a further extension of the waterfront in the future."

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[50] See Chapter 126, Laws of 1806; Chapter 115, Laws of 1807.

[51] In addition to the cases discussed in the text, *infra,* see Matter of Mayor of New York, 182 N. Y. 361 (1905); Bedlow v. N. Y. Floating Dry Dock Co., 112 N. Y. 263, 273 (1889). For a statement of the limitations of the rights of riparian owners, see Sage v. Mayor, 154 N. Y. 61 (1898), cited with approval in Scranton v. Wheeler, 179 U. S. 161 (1900), where Judge Vann said that as against the general public, riparian owners "have no rights that do not yield to commercial necessities, except the right of preemption, when conferred by statute, and the right to wharfage, when protected by a grant and covenant on the part of the state, as in the Langdon and Williams cases."

[52] 93 N. Y. 129, 144, 148, 158, 161 (1883).

"These views have at least in part been answered by what has already been written. As we think we have shown, the State could have made the grant to Astor as broad as the plaintiff claims it to be. It could make the same grant to the city, and it could authorize it to make the grant to an individual. Under its old charters and the acts of 1798 and 1807, the city had the right to build wharves along its waterfronts, and to take the wharfage accruing therefrom. The land under water with the rights of wharfage was property belonging to its proprietor, which it is believed, the State could not take without making compensation. (Dill. on Mun. Corp. [2d ed.], sec. 40; Cooley's Const. Lim. [4th ed.], p. 292.) It is property which it could lease and sell to individuals, and which it has always been accustomed to lease and sell, and its right to do so is provided for or recognized in various acts of the Legislature."

Judge Earl said further: "The views we have expressed leave the city and the State with ample power to improve the harbor of the city in the interest of commerce. The right of eminent domain is not impaired and has not been surrendered. The Legislature cannot surrender it, and it may be exercised whenever the public exigencies call for its exercise. It would doubtless be less expensive for the city arbitrarily to take this easement and thus appropriate the wharfage to its own use. But a constitutional barrier stands in the way. It, however, imposes no burden upon the city, in requiring it to make compensation for what it takes, as it gets a dollar of value for every dollar it is obliged to pay."

The reason for the liberal attitude of the courts toward the city's rights has been expressed by Judge Finch with his usual happy phraseology: "The State owned but a single seaport open to commerce and touched by tide water, and that one a harbor of remarkable size and convenience. Its interest to concentrate there ships and cargoes from all parts of the world, by protecting the harbor and lining it with docks and piers, was very great, and took on the character of a duty due to the prosperity of the commonwealth. It early imposed that duty upon the city and the citizens by whom it has been steadily performed, at very great cost, and one in the future to be largely increased. Every grant the State made was in aid of the expenditure involved in the performance by the city of that duty, and in consideration of that performance. Little enough of its own duty has been borne by the State, and to call that little a pure gratuity amounts almost to a sarcasm."[53]

It has further been decided by the courts that the city is, under the old charters, exclusive owner of the right to maintain and operate all ferries to and from it. In *Mayor* v. *Starin*[54] the question was considered at length and the court reached the decision that: "The sovereign was competent to grant and the city to receive these ferry franchises. Such a franchise is property, and the sovereign power is just as able to make an irrevocable grant of it as of any other property. If it can grant a ferry franchise for a term of years, it can do so forever. By so doing, it does not part with any political or governmental functions. It still may regulate the conduct of the ferry for the public good and control the tolls to be charged; and it can resume the proprietary right in the franchise only by exercising the right of eminent domain or by forfeiture enforced through regular judicial proceedings. By this grant the city did not merely receive the political right to establish and regulate ferries, but it received the property in the ferry franchises as it received the other property granted to it by its various charters; and we do not find any evidence in the record that what it so received it has ever lost or been deprived of."

It will be noted that in this passage the court treats the city as holder of an assignable franchise only, and not as the complete substitute for the sovereign in the control over ferries, and therein suggests a principle which has not been stated in the cases construing the land grants to the city under the same charter. From the land cases it might be deduced that the city itself occupies, as to these water lands, the position of a sovereign power, and that this authority given by the State, once granted, was irrevocable. The distinction suggested by the *Starin* case is, however, more consonant with the general principles of sovereignty, that in fact the city holds all lands and other rights under the charters, *not* as *sovereign,* but as *owner* only, that herein its position is distinguishable from that of private grantees of the State (which we have before considered) because in the city's case the grant was of the *fee* in the water lands, while in the other it was only of the *right of user;* but that nevertheless, while the city thus occupies a position stronger than that of private riparian owners, and while it holds these lands impressed with the same public trust that existed against the State, yet the State still remains charged, concurrently with the city, to assure that such public trust is peformed, may still enforce the trust, as it could against a private grantee, and *if necessary for the public interest* may still by the exercise of the power of eminent domain retake the lands which it has granted. That such necessity has never yet arisen does not destroy the principle.[55]

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[53] Williams v. Mayor, 105 N. Y. 419, 433 (1887).

[54] 105 N. Y. 1, 15 (1887).

It is well settled, however, that at the present time the city, and not the State, is owner in fee of the water lands around Manhattan Island. As heretofore stated, it seems that grants by the city to individuals are to be treated on the same principle as similar grants by the State — not as gifts of title, but as gifts of franchises. There is this difference to be noted, however, that the policy of the State and of the city as to these lands differs, for while the State has left to others the task of development, it is now and for the last half century or more has been, the city's policy to reacquire those franchise rights which she had before granted and herself to undertake the development of the waterfront and by a system of short-term leases to keep it under her control. This policy has been judicially recognized recently,[56] and should make less arduous the survey of the Manhattan shore to determine the status of its waterfront property.

(*d*) *Waterfront Franchises — Limitation and Regulation*

Grants of waterfront land within the Port of New York by the sovereign may purport to pass the fee of such land, but in fact they are grants only in the nature of a franchise to use such land for the public benefit, and it is beyond the power of the State Legislatures to pass title to such lands so absolutely that the State completely loses control of such lands. There is always a reservation from such grants, *whether expressed or not,* of a right remaining in the State to enforce over these lands the paramount commercial interest of the public, and so jealous are the courts of this public right that they have even refused to countenance grants which, although they were in furtherance of commercial interests, were so sweeping and so extensive as substantially to impair the general control of the State over the lands and waters given or those remaining. Such a grant "is necessarily revocable, and the exercise of the trust by which the property was held by the State can be resumed at any time." [57] Whether or not the State of New Jersey or the United States Supreme Court would hold that the grants to railroad corporations along the eastern shore of New Jersey were so extensive as to involve an impairment of the navigability of the river and thus come within the two decisions just referred to (the *Chicago* and the *Long Sault* cases) is, of course, difficult to say. Many of these grants were made for the promotion of commerce and the operation of these facilities is, in large measure, necessary for the conduct of the commerce of the port. That they substantially interfere, however, with the further development of the facilities of commerce at the port is clear; nevertheless it would be rash to assert that there is clear and undoubted authority for the State of New Jersey to resume possession of this waterfront without compensation to the present owners.

Starting with the assumption, however, that the grants of New York harbor lands were constitutional and were *franchises in aid of commerce,* the power of regulation reserved to the States may in itself be adequate to serve the needs of both States and the nation. These franchises are private property in the hands of individual owners and may not be taken for a public use except under the power of eminent domain and upon payment of compensation; but their exercise may be *regulated* by the States or nation in the interests of commerce and navigation to any degree short of actual seizure of the property. The distinction between the regulatory power of Congress and the States and the conscription of a franchise is made clear by a comparison of the decision in *Monongahela Navigation Co.* v. *U. S.*[58] with the late case of *Louisville Bridge Co.* v. *U. S.*[59] In the *Monongahela* case there was a physical taking over of certain locks and dams constructed and maintained by a navigation company by State authority. The Supreme Court held that "the franchise is a vested right. The State has power to grant it. It may retake it, as it may take other private property, for public uses, upon the payment of just compensation. A like, though a superior, power exists in the national government. It may take it for public purposes, and take it even against the will of the State; but it can no more take the franchise which the State has given than it can any private property belonging to an individual." [60] In the *Louisville Bridge* case the Secretary of War required the alteration of the Ohio Falls Bridge within three years, so as to provide an enlarged horizontal opening for the main navigable channel and to change the swing span across the canal to a lift-span having a prescribed horizontal clearance and a prescribed vertical clearance when open. The Ohio Falls Bridge was constructed by act of Congress following the Civil War. Despite the great expense of the required alteration (over $400,000), the court held that this was not the taking over of property for which compensation must be made, but was merely permissible regulation thereof.

Accordingly, it has been held in numerous cases and of a variety of subjects that individuals accept all grants of water lands charged with this public trust. A street railway, permitted by the City of Chicago to construct a tunnel under the Chicago River, may, when the increased demands of navigation justify the deepening of the river, be required at its own expense either to remove the tunnel or lower it.[61] So also the owners of a bridge, lawful and non-obstructive when erected, may be required to remove or alter it when by changed commercial conditions it becomes obstructive.[62] This is the principle applied generally to all franchises, such as those to gas companies to lay pipes in the street,[63] or to a railroad company whose right of way crosses a highway or stream,[64] or to other public utilities.[65] Interference with their structures is not "a taking of private property for public use, but only a consequential injury to a right which must be enjoyed, * * * 'in due subjection to the rights of the public' — an injury resulting incidentally from the exercise of a governmental power for the benefit of the general public, and from which no duty arises to make or secure compensation to the riparian owner. The riparian owner acquired the right of access to navigability subject to the contingency that such right might become valueless in consequence of the erection under competent authority of structures on the submerged lands in front of his property for the purpose of improving navigation." [66]

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[55] See discussion of Long Sault Development Co. v. Call, and Illinois Central Railroad Co. v. People, *infra* note 57.

[56] Matter of City of New York, 228 N. Y. 140, 146 (1919).

[57] Quoted from opinion in Illinois Central Railroad Co. v. People of State of Illinois, 146 U. S. 387, 45[illegible] (1892). In this case a grant to the Illinois Central Railroad of a substantial part of the water front of Lake Michigan was held to be invalid, both because the grant amounted to abdication of general control of the state over lands under the navigable waters of an entire harbor and because of the great area and immense value of the lands granted. In effect improvidence on the part of the legislature was the test. In line with this case is Long Sault Development Co. v. Call, [illegible]12 N. Y. 1 (1914), affd. 242 U. S. 272 (1916). Here the state created a corporation to construct and maintain dams in connection with the St. Lawrence river. The act was held unconstitutional on the ground that it "virtually turns over to the corporation entire control of navigation at the Long Sault rapids." See also U. S. v. Mission Rock Co., 189 U. S. 391 (1902). Under the doctrine of these cases, it seems that the principle suggested above, *supra*, note 55, that the state *could not* abdicate its control over the waterfront of New York harbor, is sound.

[58] 148 U. S. 312 (1892). [59] 242 U. S. 409 (1916). [60] P. 341.

[61] West Chicago Street Railway Co. v. Illinois, 201 U. S. 506 (1905).

The power of regulation over waterfront property is not limited to Congress, but is a matter properly within the police power of the States.[67] Obviously, upon principles too well settled to require citation, the exercise of the power must not be arbitrary and unreasonable, but must bear substantial relation to the public objects which the government may legally accomplish; otherwise the courts will disregard mere form and will interfere to protect the private owner. But, with this limitation, broad powers of regulation in the interest of improving the navigability of those waterways which constitute the great public highways of the Port of New York still remain with the two States as part of the police power. *In the establishment of such regulations there is no interference either with contract or property rights.*

OTHER PROPERTY RIGHTS

Hitherto we have considered only the questions of property raised by the ownership of waterfront lands or interests over the tideway. There is, however, another class of property rights the existence of which has a most important bearing upon the action of the State Legislatures in creating a Port Authority such as that proposed.

In pursuance of the policy of the City of New York, hitherto stated, to own and develop its own waterfront, bonds, of which an amount valued at $122,872,036 was outstanding in 1918, have been issued to secure funds for this development, and as security for the payment thereof is pledged all of this city waterfront property. By the Constitution of the State of New York[68] the city is forbidden to borrow more than 10 per cent. of the assessed valuation of the real estate within its city limits, but in the computation of the indebtedness, property which is self supporting, that is, pays the interest and sufficient to create a sinking fund to amortize the principal of the debt, is excepted. It would seem, therefore, as though the city's dock and ferry property involved not merely the rights of the city itself, but also the rights of those holders of municipal securities which have been issued upon the basis of the ownership of the docks and ferries by the city.

We shall presently consider the power of the State to alter or destroy municipal corporations; but, recognizing this power of the State to change municipal boundaries, the United States Supreme Court has held, nevertheless, that, so far as the impairment of the obligation clause of the Federal Constitution is concerned, the power of the State to alter or destroy its municipal corporations is not greater than the power to repeal its legislation, and the alteration or destruction of subordinate governmental divisions is not the proper exercise of legislative power when it impairs the obligations of contracts previously entered into,[69] nor can the State pass laws by which the Legislature attempts to dispose of the city's revenues without its consent.[70] Here again the underlying purposes and effect of the statute, and not its form, are the true tests by which the courts will measure its constitutionality.[71]

While it seems, therefore, that the State may if it should so determine, acquire title to any property owned by the city, it must do so under terms which recognize the city's obligations to holders of the city's bonds, and recognize the city's interest in the revenue derived from such property.

AGENCIES THROUGH WHICH THE STATE MAY ACT — PUBLIC AND PRIVATE CORPORATIONS

Having determined now what the States of New York and New Jersey may do, the practical question arises, through what agencies should they act? Obviously, the body to which this power is delegated must have authority over territory now divided among some three or four score separate municipalities, and hence at the outset the possibility of employing, as a Port Authority, any one of the cities involved may be discarded.

It is, of course, possible for the sovereign authority to accomplish acts permissible to itself through an agent, and that agent may be a private corporation. In a sense the cases heretofore cited, wherein private owners have been granted State and city lands for the specified purpose of improving them through the erection and development of a pier system, are within this rule; but there are many cases where the question has been squarely presented to the courts and they have consistently held that both the State and Federal authority may be exercised through the medium of a private corporation.[72]

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[62] Union Bridge Co. v. U. S., 204 U. S. 364 (1906), quoting from Lake Erie & Western Railroad Co. v. Cluggish, 143 Ind. 347 (1895) and *id.* v. Smith, 61 Fed. 885 (1894): Scranton v. Wheeler, 179 U. S. 141 (1900). See also Pierce Oil Corporation v. City of Hope, 248 U. S. 498 (1918); Matter of Public Service Commission (Montague St.), 224 N. Y. 211 (1918); People v. International Bridge Co., 223 N. Y. 137 (1918).

[63] New Orleans Gas Light Co. v. Drainage Commissioners, 197 U. S. 453 (1904).

[64] The cases bearing on this principle are numerous. See Chicago, Milwaukee & St. P. Railway Co. v. Minneapolis, 232 U. S. 430 (1913); Cooke v. Boston & Lowell R. Corp., 133 Mass. 185 (1882), approved in the Union Bridge Co. case, *supra*, note 62; Erie Railroad Co. v. Public Utility Commissioners, 89 N. J. L. 57 (1916); New York Central Case, 202 N. Y. 212 (1916).

[65] New Orleans Gas Light Co. v. Drainage Comm., 197 U. S. 453 (1904); Natick Gas Co. v. Natick, 175 Mass. 246 (1899); New England T. & T. Co. v. Boston Terminal Co., 182 Mass. 397 (1903); Detroit v. Fort Wayne & Elmwood Ry. Co., 90 Mich. 646 (1892); Stillwater Co. v. Stillwater, 50 Minn. 498 (1892); Columbia Gas & Coke Co. v. Columbus, 50 Oh. St. 65 (1893).

[66] Union Bridge Co. v. U. S., 204 U. S. 364, at p. 393

[67] Chicago, M. & St. P. Railway Co. v. Solan, 169 U. S. 133, 137 (1897). See also People v. N. Y. & Staten Island Ferry Co., 68 N. Y. 71, 76 (1877).

[68] Article 8, sec. 10.

[69] Mt. Pleasant v. Beckwith, 100 U. S. 514 (1879); Mobile v. Watson, 116 U. S. 289 (1885); Graham v. Folsom, 200 U. S. 248 (1905).

[70] People *ex rel.* Rodgers, 166 N. Y. 1 (1901).

[71] Henderson v. Mayor of New York, 92 U. S. 259 (1875); People v. O'Brien, 111 N. Y. 1 (1888).

[72] California v. Central Pacific Railroad Co., 127 U. S. 1 (1887); Luxton v. North River Bridge Co., 153 U. S. 525, 529 (1893); Wilson v. Shaw, 204 U. S. 24 (1906); Stockton v. Baltimore & New York Railroad Co., 32 Fed. 9 (1887).

It is more usual, however, for the State to act through some subordinate administrative body in the form of a board or commission, and it may now be regarded as fundamental, so unanimous are the decisions upon the point, that the Legislature has the right to delegate to such a body, not the exercise of its own functions, it is true, but the *execution* and *administration* of projects upon the general outlines of which it has itself decided but over the performance of which supervision is necessary.[73] The necessity and the wisdom of such delegation are no longer in question. In the instant case the Legislatures having determined that certain remedies, including centralization of control, must be applied to the ills of the port, cannot as a practical matter themselves undertake the application of those remedies; cannot, for obvious reasons, delegate the task to any one of the existing municipalities; would not, as a matter of policy, and could not, as a matter of law, entrust the execution of so great a task involving such an incalculable public interest, to the hands of a corporation controlled by private individuals; and are therefore relegated by necessity to the employment of a municipal corporation specially created, with special attributes, special powers, and charged solely with the supervision of the widespread activities of the Port of New York.

There is an additional and most important reason for choosing such a body as agent of the State. The Constitution of the State of New York limits the borrowing capacity of the City of New York, and the Constitution of the State of New Jersey limits the borrowing capacity of the State. By the New Jersey Constitution[74] the Legislature may not in any manner create any debt or liability of the State exceeding $100,000 without the previous approval of the people at a general election. But this provision the courts of both States have held *has no application to local or municipal indebtedness.*[75] Hence the capacity of the new Port Authority, as a body corporate or politic, to borrow money is not limited by the constitutional limitations on the borrowing capacity of the State of New Jersey or the City of New York. The argument that this is to create a power which the State itself does not possess is invalid. "The State may have power to grant a power, and at the same time not have power to execute it. This is clearly shown by reference to this very prohibition [constitutional debt limitation] against its being a party in carrying on internal improvements. No one doubts that it may authorize a railroad company to build a railroad. But it could not build one itself. And is that deriving power from a source where it does not exist? Clearly not. Because the State has the power to grant the authority, and is prohibited only from being itself a party in its execution. The difficulty with this objection is, that it confounds the power of granting a right with the power of being a party to its exercise; whereas the two are essentially distinct."[76]

The importance of choosing to direct the development of the Port a body which is free from this limitation upon borrowing capacity cannot be exaggerated, for the project must be managed upon the same principles that would govern a business corporation in like instance, financed by money borrowed upon the security of the facilities to be created and eventually supported by the income to be derived therefrom.

The proposed Port District will include some sixty and more separate cities and towns, each existing under a charter declaring its right as an independent political body. How far will the existence of these interfere with the creation of a joint Port Authority? Not at all. A municipal corporation is a body existing solely as an agent of the State, organized, it is true, to make effective that principle of local self government which is the basis of our whole democracy, and which is nowhere more developed than in the East, but nevertheless it is purely an agency. And while constitutional guaranties assure to its inhabitants security from unwarranted interference with their local interests, yet the adjudicated cases give ample authority for the creation of a body similar to the proposed Port Authority. From its very nature, the powers of a municipal corporation are subject to revision at the will of the State, not perhaps so far as such revision would amount to a discrimination against the locality, but certainly so far as it is only a resumption of or a transfer by the State of the political jurisdiction delegated by the State.[77] And a change like that proposed is such a transfer only and not an unconstitutional interference with local rights, for it is well settled both in New Jersey and New York that the mere coincidence of boundaries of a city or county and of the territory subjected to the jurisdiction of some other executive or administrative body is not *ipso facto* an invasion of the right of local self government, and the creation of bodies with purposes similar to that of the proposed Port Authority, and with analogous powers, has continuously been held permissible.[78]

JOINT ACTION OF THE STATES

Hitherto we have confined our consideration of the legal problems involved in the proposed port plan as though they affected but one State alone. It is, however, clearly permissible for the two States to undertake jointly what either of them could do, and thus to effectuate through combined action a result which would be impossible to one State working alone.

It is true that by the Federal Constitution it is provided that "no State shall, without the consent of Congress, lay any duty of tonnage, keep troops or ships of war in time of peace, enter into any agreement or compact with another State, or with a foreign power, or engage in war, unless actually invaded, or in such immediate danger as will not admit of delay." While this provision, if literally interpreted, would forbid any compact such as that proposed, the courts of the United States have consistently ruled that it is not so to be read, but that it prohibits only compacts between the States which affect injuriously the jurisdiction of the United States. The United States Supreme Court has illustrated the nature of the agreements which are within the prohibition of the foregoing provision as follows: "The compact or agreement will then be within the prohibition of the Constitution or without it, according as the establishment of the boundary line may lead or not to the increase of the political power or influence of the States affected, and thus encroach or not upon the full and free exercise of Federal authority. If the boundary established is so run as to cut off an important and valuable portion of a State, the political power of the State enlarged would be affected by the settlement of the boundary; and to an agreement for the running of such a boundary, or rather for its adoption afterwards, the consent of Congress may well be required. But the running of a boundary may have no effect upon the political influence of either State; it may simply serve to mark and define that which actually existed before, but was undefined and unmarked. In that case the agreement for the running of the line, or its actual survey, would in no respect displace the relation of either of the States to the general government."[79]

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[73] Wayman v. Southard, 10 Wheat. (U. S.) 1, 43-46 (1825); Field v. Clark, 143 U. S. 649, 683 (1891); Butterfield v. Stranahan, 192 U. S. 470, 496 (1903); McKinley v. U. S., 249 U. S. 397 (1919); Erie R. R. Co. v. Public Utility Comm., 89 N. J. L. 57 (1916); Saratoga Springs v. Saratoga Gas Co., 191 N. Y. 123 (1908); Cincinnati, etc. Co. v. Clinton County Comm., 1 Oh. St. 77, 88 (1852); Moers v. Reading, 21 Pa. 188, 202 (1853). The legislature may delegate such duties not only to an administrative official or body but also to the judiciary. In addition to the above cases, see Canada Northern Railway v. International Bridge Co., 7 Fed. 653 (1880), and 8 Fed. 190 (1881); People v. Babcock, 11 Wend. (N. Y.) 587 (1834); Commissioners of Warwick v. Judges of Orange County, 13 Wend. (N. Y.) 432 (1835); Citizens Savings Bank v. Town of Greenburgh, 173 N. Y. 215 (1903).

[74] Article 4, sec. 6, par. 4.

[75] Van Cleve v. Passaic Valley Sewerage Commissioners, 71 N. J. L. 183 and 574 (1904). See also Pattison v. Board of Supervisors, 13 Cal. 175, 182 (1859); People v. Flagg, 46 N. Y. 401, 406 (1871); Cass v. Dillon, 2 Oh. St. 607, 613 (1853); Clark v. City of Janesville, 10 Wis. 119 (1859); Bushnell v. Belvit, *id.* 155 (1859); Cooley on Constitutional Limitations (7th ed.), p. 325.

[76] Clark v. City of Janesville, 10 Wis. 119, at pp. 133-134.

[77] Dartmouth College case, 4 Wheat. (U. S.) 518 (1819); Atkin v. Kansas, 191 U. S. 207, 220 (1903); Darlington v. Mayor, 31 N. Y. 164, 196 (1865); People *ex rel.* Palmer v. Travis, 223 N. Y. 150 (1918).

[78] Van Cleve v. Passaic Valley S. Comm., *supra*, note 75; State v. Price, 71 N. J. L. 249 (1904); Metropolitan Board of Health v. Heister, 37 N. Y. 661 (1868); People v. Draper, 15 N. Y. 532 (1857).

As to all matters which do not unduly increase their political influence, the States have the same freedom to contract *inter sese* as have individuals, or, more properly, as have nations, and such contracts have repeatedly been before the courts for an interpretation and have been upheld.[80]

Furthermore, it is to be noted that so successful were the individual States under our Federal system of government in retaining their own complete and independent sovereignty, except as to matters expressly delegated to the nation, that any questions arising between them are treated as though they were individual nations and are interpreted by the canons of international law. It is very evident that it would be impossible to determine any disputes which might so arise by the local rules applicable in the State courts, since most frequently upon such controversies the rules in the two States concerned are diametrically opposed, and it has therefore been held that when "the question arises under, and is to be decided by, a compact between *two states:* . . . the rule of decision is not to be collected from the decisions of either State, but is one, if we may so speak, of an international character."[81]

In the present case, the right which each State desires to give to and receive from the other is technically a servitude. We shall presently review the principles of international servitudes and the international precedents bearing upon the problem, but before so doing we may properly consider the method by which the treaty between two States of the Union may be enforced.

While the agreements between New York and New Jersey are to be controlled by the principles of international law, their relations to each other are in one important respect that of subordinate and not of independent sovereignties. Because of the Federal union existing between the States of this nation, it is possible to reach one result which could not be attained between nations actually independent. Where an agreement has been made between two States of the Union and has received the approval of Congress, if later dispute arise between the two States, or if one becomes recalcitrant in the execution of its obligations entered into, there remains a higher power, the nation, to enforce the performance. While, naturally, disputes such as this have not often arisen between members of the same friendly union, the language of Chief Justice White, writing for the United States Supreme Court in the case of *Virginia* v. *West Virginia,*[82] clearly indicates the opinion of that court that no State is entitled, because of its sovereign position, to escape the consequences of its agreements entered into. He says: "The vesting in Congress of complete power to control agreements between States, that is, to authorize them when deemed advisable and to refuse to sanction them when disapproved, clearly rested upon the conception that Congress, as the repository not only of legislative power but of primary authority to maintain armies and declare war, speaking for all the States and for their protection, was concerned with such agreements, and therefore was virtually endowed with the ultimate power of final agreement which was withdrawn from state authority and brought within the federal power. It follows as a necessary implication that the power of Congress to refuse or to assent to a contract between States carried with it the right, if the contract was assented to and hence became operative by the will of Congress, to see to its enforcement. * * *

"Having thus the power to provide for the execution of the contract, it must follow that the power is plenary and complete, limited, of course, as we have just said, by the general rule that the acts done for its exertion must be relevant and appropriate to the power. * * * Obviously, if it be conceded that no power obtains to enforce as against a State its duty under the Constitution in one respect, and to prevent it from doing wrong to another State, it would follow that the same principle would have to be applied to wrongs done by other States, and thus the government under the Constitution would be not an indissoluble union of indestructible States, but a government composed of States each having the potency with impunity to wrong or degrade another,— a result which would inevitably lead to a destruction of the union between them."

Whether the power to spur the refractory member into action lies primarily with Congress or with the Supreme Court, that court refused definitely to decide, but the language used seems to be a full and adequate indication of what either Congress or the court, or both, may do to a State which refuses to meet its solemn obligation to another. The States waive their exemption from judicial power as sovereigns of original inherent right by their own grant of its exercise over themselves given in the Constitution.

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[79] Virginia v. Tennessee, 148 U. S. 503, 520 (1892).

[80] The leading case is Chesapeake & Ohio Canal Co. v. Baltimore & Ohio Railroad Co., 4 G. & J. (Md.) 1 (1832). Wilson v. Shaw, 204 U. S. 24, 32 (1906); Matter of Townsend, 39 N. Y. 171 (1868).

[81] From Marlatt v. Silk, 11 Pet. (U. S.) 1, 22 (1837). In accord are Iowa v. Illinois, 147 U. S. 1 (1892); and Brien v. Elliott's Heirs, 2 Pen. & Watts (Pa.) 49, 61 (1830).

[82] Virginia v. West Virginia, 246 U. S. 565 (1917).

SERVITUDES

Two owners of adjoining farm lands require access across both for the full development of the farms of both. To confirm this access they draw a deed or instrument by which the rights are established. The thing created in law is called an "easement," and the burden imposed upon the land which is to serve the easement is called a "servitude;" each piece of property *serves* the other.

In urban real estate there is a very common illustration. Two owners of lots adjoining each other intend to erect separate buildings. Ordinarily, each would erect a separate wall at or near the line of intersection. Where land is expensive, what more natural than for one owner to say to the other: "Let us erect a wall which will serve both buildings and which will be common to us both." This is what is called a "party wall," and an agreement of this character is called "a party wall agreement." Each piece of property is the beneficiary of a *servitude* assumed by the other. In Roman law "the one piece of land was said to *serve* the other." (Imperatores Justiniani Institutiones, 2d ed., p. 26, note.) Sir Robert Phillimore, in his "International Law," Vol. 1, 3d ed., 1879, says: "In the language of Jurisprudence, when a thing is subject to the exercise of a right by a person who is not the master or proprietor it is said *to serve* (*res servit*) or yield *service* to that other person." This doctrine of *Servitus* plays an important part in Roman law, and in some shape and under some appellation or other is to be found in the jurisprudence of all nations. The obligation to service "constitutes a right in the obligee or the person to whom it is due, and it ranks among the '*jura in re*,' while it operates as a diminution and limitation of the right of the proprietor to the exclusive and full enjoyment (*libertas rei*) of his property." Under Roman law the servitudes consisted either in not doing something (*in non faciendo*) and was negative (*servitus negativa*), or in suffering something to be done (*in patiendo*) and was affirmative (*servitus affirmativa*). Where the owner of a thing assumed the obligation to do something (*in faciendo*) in relation to that thing for the benefit of another, this obligation assumed a technically different character and was not regarded as a *jus in re*. "But (as Bluntschli warns us)," says Sir Edward S. Creasy (Creasy: The First Platform of International Law, 1876, § 256), "much caution is requisite in applying to international law the doctrines of the Roman law as to prædial servitudes, urban servitudes, rustic servitudes, and other forensic distinctions." Nevertheless, the principles of "international servitude" are fairly well established and history presents many applications of them.

Probably nowhere in the history of international law has the subject received fuller examination and study than in the North Atlantic Coast Fisheries Arbitration before the Hague Tribunal of Arbitration. In the twelve or thirteen volumes forming the record of this case will be found the expressions upon the subject of nearly every international writer and of all the great international lawyers. English translations of extracts from works of Argentinian, Austrian, Belgian, French, German, Italian, Russian, Spanish and Swiss publicists, together with extracts from the works of British and American publicists, were compiled by James Brown Scott for use before the Hague Tribunal. This volume, called "International Servitudes," printed by the Government Printing Office in 1910, is undoubtedly the most valuable collection of authorities on the subject.

Sir Robert Phillimore once said (Vol. 9, Proceedings before the Hague Tribunal, North Atlantic Coast Fisheries Arbitration, 569 [338]): "In the memorable answer, pronounced by Montesquieu to be *réponse sans réplique*, and framed by Lord Mansfield and Sir George Lee, of the British to the Prussian Government,

"'The law of nations is said to be founded upon justice, equity, convenience, and the reason of the thing, and confirmed by long usage.'

"It is more especially to this usage, as evidencing the consent of nations, that great judges, such, among others, as Lord Stowell and Chancellor Kent, and great jurists of all countries, have continually referred."

From the wealth of learning contained in the volume to which we have referred, we take the following (Vol. 1, Sir Robert Phillimore's "International Law," 3d ed., 1879, § 277): "The property of a state may not only be alienated, but may also be subjected to *obligations* and *services* in favor of another state; as the property of an individual may be burdened and encumbered in favor of another individual."

§ 279. "States are sometimes placed in such physical relations to each other that some limitations of the abstract rights of each *necessarily* flow from their natural relations, or from the reason of the thing. Thus a state is bound to receive the waters which *naturally* flow within its boundaries from a coterminous State. This obligation belongs to the class of '*servitutes* juris gentium *naturales*,' and here the provisions of the Digest and Institutes may be said to be identical with those of International Law."

§ 280. "A State may *voluntarily* subject herself to obligations in favor of another state, both with respect to persons and things, which would not *naturally* be binding upon her. These are '*servitutes* juris gentium *voluntariæ*.'"

Hannis Taylor, in "A Treatise on International Public Law," section 217, says: "A state may limit or qualify its sovereignty and jurisdiction over its territorial property by permitting a foreign state to perform within its bounds certain acts otherwise prohibited; or by surrendering the right to exercise certain parts of its domestic jurisdiction as a protection to others. Restrictions thus imposed upon the sovereignty of a state are known as servitudes, which may be either positive or negative."

Dr. L. Oppenheim, "International Law," section 205: "Since the territory of a state includes not only the land, but also the rivers which water the land, the maritime belt, the territorial subsoil, and the territorial atmosphere, all these can, as well as the service of the land itself, be an object of state servitudes. Thus a state may have a perpetual right of admittance for its subjects to the fishery in the maritime belt of another state, or a right to lay telegraph cables through a foreign maritime belt, or a right to build and use a tunnel through a boundary mountain, and the like. And should ever aerostation become so developed as to be of practical utility, a state servitude might be created through a state acquiring a perpetual right to send military aerial vehicles through the territorial atmosphere of a neighboring state."

Senator Root, in his argument before the Hague Tribunal (see Vol. 11, p. 1285), after reading from Bluntschli, Bonfils, Calvo, Chrétien, Clauss, Despagnet, Diena, Fabre, Fiore, Hall, Hartmann, Heffter, Heilborn, Hollatz, Holtzendorff, Klüber, Lomonaco, G. F. de Martens, Neumann, H. B. Oppenheim, L. Oppenheim, Phillimore, Rivier, Ullmann, at page 1287 (2129), culls as a well-settled principle the following: "Since anybody can grant any right he chooses to a third party concerning his thing, so has each nation a right to grant another nation a certain right in its territory. * * * It belongs even to the mutual duties of nations for the one to create certain rights in his territory for the advantage of the other, in so far as no abuse of the territory takes place."

THE NORTH ATLANTIC COAST FISHERIES CASE

In the argument before the Hague Tribunal, George Turner, one of the counsel for the United States (Vol. 9, North Atlantic Coast Fisheries Arbitration, 564 [335]), said: "When one nation grants to another certain rights to be exercised within its territorial limits, rights which possess the attributes and qualities of a servitude by the municipal law, it creates a relation between itself and the other nation which is analogous to the relation which exists between the owners of the dominant estate and the servient estate by the municipal law, in view of the fact that the sovereignty which nations possess, under the conception of to-day, constitutes a species of higher ownership, which the nations may contract about, or may burden or may dispose of, in whole or in part, at their will and their pleasure. When such a grant is made by one nation to another, to be exercised within its territories by the other, a right to resort to the territory and to employ the territory for profit, which right is a perpetual right, and is strictly a national right, we have, in fact, every one of the concepts, every one of the qualities, every one of the attributes of the servitude as it was known to the Roman law."

The controversy before the Hague Tribunal in the Fisheries Arbitration presented a number of interesting questions. The one with which we are concerned, however, called for an interpretation of the fisheries provision of the Treaty of 1818 and arose out of the clause of the treaty which provided that "the inhabitants of the United States shall have forever, in common with the subjects of His Britannic Majesty, the liberty to take fish of every kind," on the so-called treaty coast. "The British contention," says Mr. Anderson (Chandler P. Anderson: The Final Outcome of the Fisheries Arbitration — The American Journal of International Law, January, 1913), "rested on the argument that the words 'in common with the subjects of His Britannic Majesty' meant that American fishermen should be on exactly the same footing as local fishermen in British waters, and therefore subject to the same governmental control exercised by Great Britain and her Colonies over British subjects. The United States, on the other hand, showed by the negotiations resulting in that treaty, as well as by means of the antecedent French fishing treaty rights on the Newfoundland coast, that the words 'in common' were used to negative the implication, which otherwise would have arisen, that American fishermen were to have an exclusive right of fishing. The United States further maintained that, instead of subjecting American fishermen to local regulations, the effect of the treaty was either to establish a fishery common to both nations, in which the United States had an equal interest with Great Britain, thus creating an international servitude depriving Great Britain of a portion of her sovereignty in the treaty waters, or else, in the alternative, that the treaty must be regarded as imposing upon Great Britain a contractual obligation limiting the exercise of British sovereignty in treaty waters, to the extent that the prerequisite of reasonableness must be determined before regulations could be enforced against American fishermen, and that neither Great Britain nor her Colonies could be the sole judge of the question of reasonableness."

In his dispatch to the United States Ambassador in London, Secretary Root said: "The treaty of 1818 either declared or granted a perpetual right to the inhabitants of the United States, which is beyond the sovereign power of England to destroy or change. It is conceded that this right is, and for ever must be, superior to any inconsistent exercise of sovereignty within that territory. *The existence of this right is a qualification of British sovereignty within that territory.*" (Vol. 4, North Atlantic Coast Fisheries Case, Brief for Great Britain, pp. 18, 19.) In the memorable communications between Lord Salisbury and Secretary Evarts (*Ibid.* 29, 30, 31) Lord Salisbury said: "* * * Her Majesty's Government will readily admit — what is, indeed, self-evident — that British sovereignty, as regards those waters, is limited in its scope by the engagements of the Treaty of Washington, which cannot be modified or affected by any municipal legislation. I cannot anticipate that with regard to these principles any difference will be found to exist between the views of the two Governments." Mr. Evarts replied (1879) that he had nowhere taken any position larger or broader than that stated by Lord Salisbury in the quotation just made. "I have never denied the full authority and jurisdiction either of the Imperial or colonial Governments over their territorial waters, *except so far as by Treaty that authority and jurisdiction have been deliberately limited by these Governments themselves.*"

Sir W. Robson, of counsel for Great Britain before the Tribunal (see discussion, Vol. 11 [1011], 1674 *et seq.*), in a most enlightening colloquy with Dr. Drago of the Hague Tribunal, stated that "a State may make, for instance, with regard to a railway, a contract with another State, giving that other State any rights it pleases over its own territory, for the purposes of the railway * * * (1674) (1012). It is to the good of mankind, to the good of individual States, and to the good of the whole civilized community, that each State should be encouraged to open its territory to other States, either for economic purposes, or for purposes of general beneficial intercourse. I say they may do it, and I say that the existing international law allows them to do it, without danger. They may do it as sovereigns. They may put their territory, as sovereigns, under all kinds of obligations of the kind which we have heard called real obligations. They may say: 'You may come to our territory and fish, or build railways, or build warehouses. You may do all these things.' I say that those are highly meritorious grants to make; that they must be made, and they are made, without any consequence whatever of a character derogating from the sovereignty of the States. That is my case.

"So that I accept the suggestion of the learned arbitrator that such contracts can be made. I say they can be made, and ought to be encouraged. No State ought to be deterred from limiting the exercise of its own sovereignty in any of these respects. It ought not to be deterred from doing it."

In other words, the great lawyers representing England did not dispute the power of two States to join in a treaty limiting the exercise of their sovereignty in these respects, but confined the argument to the consideration of whether, *in fact,* they had done so with regard to the fisheries. Sir W. Robson laid stress upon the importance of the Hague Tribunal "in dealing with this great question, so framing its judgment as not to allow of any discouragement to States in making obligations *inter se*, which may open the territory of one to the inhabitants of another without any detriment to the sovereignty of either. That, I think, is the thing we should all aim at. And my own belief is that international law, as it is now constituted, does that. International law, when it is thoroughly considered, as it stands to-day, does allow a State to open its territory freely to limit the exercise of its own sovereign rights in certain particulars, without any detriment to its other sovereign rights or its general national sovereignty." Again, in the colloquy with Sir Charles Fitzpatrick: "States may do what they like with regard to their property. In so far as they are owners, they may subject their property to any obligation that they please. I say they may do it without any danger to their sovereignty. That is to say, they put what obligations they like upon themselves as lords of the land. A State may submit its dominium to these rights, without any derogation from its imperium * * *" Sir Charles Fitzpatrick said: "Your contention, briefly, is that a State may part with a share of the public domain, either in favour of a citizen of that State, in favour of the citizen of a foreign country, or in favour of the Government of a foreign country?" Sir W. Robson: "Yes * * * It is the essential difference between dominium and imperium, which, as one of the learned arbitrators has just pointed out, has to be considered * * * That general sovereignty is a thing wholly apart and not affected by the grant of particular territorial rights, as the United States say it is affected."

Indeed, we may say that the framers of the treaty between New York and New Jersey of 1834 had clearly in mind this distinction between the preservation of general sovereignty and governmental functions and the grant of title to land, the distinctions between the title to the land under water, which, in the case of New Jersey, extends to the middle of the stream, and the exercise of governmental police power, which is granted to one State even to the shores of the other.

In its decision, the Hague Tribunal did not support the extreme contention of our Government that Great Britain had transferred to the United States sovereign rights in the treaty waters, but "equally to the satisfaction of the United States" (as Mr. Anderson says in his article, "The Final Outcome of the Fisheries Question"), it decided that though Great Britain retained its sovereignty intact, it had nevertheless imposed a limitation upon the exercise of this sovereignty, that is to say, it was an implied condition of the treaty that whatever regulations were adopted by Great Britain covering the exercise of fishery rights, these regulations must be reasonable. The treaty, said the Tribunal, limited the inherent sovereign rights of Great Britain to regulate the liberty to take fish in and about Newfoundland "in respect of the said liberties therein granted to the inhabitants of the United States in that such regulations must be made *bona fide* and must not be in violation of the said Treaty." Accordingly, in case of any disputes as to the reasonableness of such regulations, enforcement of them against American fishermen must be suspended until they were passed upon by an impartial tribunal and held by such tribunal to be reasonable. The rules and methods of procedure which should be adopted by the two governments to carry out this decision were embodied in the award and subsequently took shape in a treaty, adopting with minor modifications the rules and methods of procedure thus recommended. This treaty was signed at Washington on July 20, 1912, and appears in full in the compilation of addresses and papers of ex-Senator Elihu Root under the title "North Atlantic Coast Fisheries Arbitration" (Harvard Univ. Press, 1917—edited by Robert Bacon and James Brown Scott). The method, briefly stated, requires the British Government, when adopting regulations, to publish them in designated newspapers for a certain period of time before they become effective, and provides that they shall not become effective with respect to the inhabitants of the United States "until the Permanent Mixed Fishery Commission has decided that the regulation is reasonable within the meaning of this award." After the publication of these regulations, the United States may convoke the Permanent Mixed Fishery Commission for the purpose of passing upon the regulations. If it shall fail, however, so to do, the regulations become effective. The Permanent Mixed Fishery Commission is made up of experts selected by both nations.

Here, then, is a clear recognition on the part of English and American lawyers, as well as a decision by the highest international court, to the effect that sovereign states may engage in the regulation of commercial privileges in territorial waters without surrendering general sovereignty, and may, for the purpose of administering such regulations or of determining their reasonableness, create a joint tribunal with final and supreme authority in the premises.

THE PANAMA CANAL

Recently the United States Government entered the cities of Panama and Colon for the purpose of maintaining order and preserving health and taking certain necessary sanitary precautions. These two cities are under the sovereignty of the Government of Panama. The authority under which the United States Government acted was the treaty with the Government of Panama. This treaty is in itself but another application of the principles under discussion, not only with reference to our dealings with the Government of Panama, but also with reference to our dealings with England. Again, the repeal of the provision in the Panama Canal Act, providing for free tolls on vessels engaged in the coastwise trade of the United States, which was claimed to be in conflict with the Hay-Pauncefote Treaty, furnishes a most instructive chapter in the modern history of our government, considered by many statesmen to be one of the most honorable chapters in the diplomacy of our country. This controversy presented the single question of the obligations that we had assumed toward the governments of other countries, especially that of Great Britain, in the building and operation of the canal. On the 5th of March, 1914, President Wilson urged the passage by Congress of the bill for the repeal of the tolls exemption in favor of the United States upon the ground that our country had assumed treaty obligations toward Great Britain which made exemption of tolls in our own favor a breach of international duty. Legal title of the United States to the Canal Zone was conceded. The sole issue was whether or not the title was subject to an obligation in the nature of a trust.

In his memorable address to the Senate on January 21, 1913, Senator Root said concerning our obligations to Great Britain: "So, Mr. President, far from our being relieved of the obligations of the treaty with Great Britain by reason of the title that we have obtained to the Canal Zone, we have taken that title impressed with a solemn trust. We have taken it for no purpose except the construction and maintenance of a canal in accordance with all the stipulations of our treaty with Great Britain. We cannot be false to those stipulations without adding to the breach of contract a breach of the trust which we have assumed, according to our own declarations, for the benefit of mankind, as the mandatory of civilization." In other words, control over the Panama territory was vested in the United States, yet was subject to a sacred trust in favor of other nations. Senator Root (in the same volume, Addresses on International Subjects), discussing "The Ethics of the Panama Question," traces the history of all the treaties bearing upon the subject and the relations between the various governments. The Treaty of December 12, 1846, between the United States and New Granada (p. 182) provided: "The Government of New Granada guarantees to the Government of the United States that the right of way or transit across the Isthmus of Panama upon any modes of communication that now exist, or that may be hereafter constructed, shall be open and free to the Government and citizens of the United States * * * And in order to secure to themselves the tranquil and constant enjoyment of these advantages, and as an especial compensation for the said advantages and for the favors they have acquired by the fourth, fifth, and sixth articles of this treaty, the United States guarantee positively and efficaciously to New Granada by the present stipulation the perfect neutrality of the before-mentioned Isthmus with the view that the free transit from the one to the other sea may not be interrupted or embarrassed in any future time while this treaty exists, and in consequence the United States also guarantee in the same manner the rights of sovereignty and property which New Granada has and possesses over the said territory." Senator Root, commenting upon this, said (p. 183): "You will perceive that in this transaction New Granada recognized the subordination of her sovereignty to the world's easement of passage by railroad or by canal, and, apprehending that other nations might seek to exercise that right through the destruction of her sovereignty and the appropriation of her territory, she procured the United States to assume the responsibility of protecting her against such treatment."

The preamble of the Hay-Pauncefote Treaty of December 16, 1901, recites that the two parties "being desirous to facilitate the construction of a ship canal * * * by whatever route may be considered expedient, and to that end to remove any objection which may arise out of the Convention of the 19th April, 1850, commonly called the Clayton-Bulwer treaty, to the construction of such canal under the auspices of the Government of the United States, without impairing the 'general principle' of neutralization established in Article VIII of that Convention," have for this purpose appointed plenipotentiaries, etc. Article 2 gave our nation the exclusive privilege to buy the right of way and to own it and to build the canal. Article 3 gave rights to protect and govern the great waterway. But Article 4 provided that no change of territorial sovereignty or of international relations of the country or the countries traversed by the canal shall affect the present principle of "neutralization" or the obligations under the present treaty.

Turning now to the international relations between the United States and Panama established by the Hay-Bunau-Varilla Treaty of February 23, 1904, we find that the United States secured a grant of lands and the franchise to build and operate a canal across Panama from ocean to ocean. By Article I, "the United States guarantees and will maintain the independence of the Republic of Panama." By Article II, "the Republic of Panama grants to the United States in perpetuity the use, occupation and control of a zone of land and land under water for the construction, maintenance, operation, sanitation and protection of said Canal of the width of ten miles extending to the distance of five miles on each side of the center line of the route of the Canal to be constructed; the said zone beginning in the Caribbean Sea three miles from mean low water mark and extending to and across the Isthmus of Panama into the Pacific Ocean to a distance of three marine miles from mean low water mark with the proviso that the cities of Panama and Colon and the harbors adjacent to said cities, which are included within the boundaries of the zone above described, shall not be included within this grant. The Republic of Panama further grants to the United States in perpetuity the use, occupation and control of any other lands and waters outside of the zone above described which may be necessary and convenient for the construction, maintenance, operation, sanitation and protection of the said Canal or of any auxiliary canals or other works necessary and convenient for the construction, maintenance, operation, sanitation and protection of the said enterprise * * *

"Article III. The Republic of Panama grants to the United States all the rights, power and authority within the zone mentioned and described in Article II of this agreement and within the limits of all auxiliary lands and waters mentioned and described in said Article II which the United States would possess and exercise if it were the sovereign of the territory within which said lands and waters are located to the entire exclusion of the exercise by the Republic of Panama of any such sovereign rights, power or authority."

"Article VII. The Republic of Panama grants to the United States within the limits of the cities of Panama and Colon and their adjacent harbors and within the territory adjacent thereto the right to acquire by purchase or by the exercise of the right of eminent domain, any lands, buildings, water rights or other properties necessary and convenient for the construction, maintenance, operation and protection of the Canal and of any works of sanitation, such as the collection and disposition of sewage and the distribution of water in the said cities of Panama and Colon, which, in the discretion of the United States may be necessary and convenient for the construction, maintenance, operation, sanitation and protection of the said Canal and railroad. All such works of sanitation, collection and disposition of sewage and distribution of water in the cities of Panama and Colon shall be made at the expense of the United States, and the Government of the United States, its agents or nominees shall be authorized to impose and collect water rates and sewerage rates which shall be sufficient to provide for the payment of interest and the amortization of the principal of the cost of said works within a period of fifty years and upon the expiration of said term of fifty years the system of sewers and water works shall revert to and become the properties of the cities of Panama and Colon respectively, and the use of the water shall be free to the inhabitants of Panama and Colon, except to the extent that water rates may be necessary for the operation and maintenance of said system of sewers and water.

"The Republic of Panama agrees that the cities of Panama and Colon shall comply *in perpetuity with the sanitary ordinances whether of a preventive or curative character prescribed by the United States and in case the Government of Panama is unable or fails in its duty to enforce this compliance by the cities of Panama and Colon with the sanitary ordinances of the United States the Republic of Panama grants to the United States the right and authority to enforce the same.*

"*The same right and authority are granted to the United States for the maintenance of public order in the cities of Panama and Colon and the territories and harbors adjacent thereto in case the Republic of Panama should not be, in the judgment of the United States, able to maintain such order.*"

By Articles VI and XV private land owners are guaranteed against damage, and any damage to private owners is to be appraised and settled by a *joint commission* appointed by the United States and Panama, whose decision shall be final. This commission is to be appointed, two by the President of the United States and two by the President of Panama. In case these disagree by being equally divided, an umpire is to be appointed by the two governments who shall render the decision. By Article XXIII the United States is given the right to employ armed force, if it becomes necessary, for "the safety or protection of the Canal, or of the ships that make use of the same, or the railways and auxiliary works."

While the United States Supreme Court did not pass upon the validity of all of the provisions of this treaty, nevertheless, in the case of *Wilson* v. *Shaw*, 204 U. S. 24, it refused to interfere with the operation of any of the provisions of the treaty. After reviewing the history preceding the execution of the treaty, Judge Brewer, speaking for the court said: "For the courts to interfere * * * would be an exercise of judicial power which, to say the least, is novel and extraordinary" (p. 31). (In the same case the power of the government to build the canal and to operate the railroad through the agency of a corporation, is fully sustained.)

THE SUEZ CANAL CONVENTION

The provisions of the Hay-Pauncefote Treaty were taken from the Suez Convention almost, says Senator Root (Panama Canal Tolls address to the Senate, January 21, 1913), "though not quite—textually." The Suez Convention contained provisions reserving to Turkey and Egypt as sovereigns of the territory through which the canal passed, treating Turkey as the suzerain and Egypt as the sovereign over Egypt, all of the rights that pertained to the sovereigns for the protection of their own territory. (The Suez Canal Convention is given in both French and English in Sen. Doc., 56th Cong., 1st Sess., 1899, Vol. 10, Doc. 151, and in English in Sen. Rep., 56th Cong., 2d Sess., 1900, Vol. 1, Doc. 1337, pt. 4, pp. 318–319, and in House Doc., 62d Cong., 2d Sess., 1912, Doc. 680, pp. 41–44, and in White's "Expansion of Egypt," p. 339 *et seq.*)

By the Treaty of Constantinople, October 29, 1888, between Great Britain, Germany, Austria-Hungary, Spain, France, Italy, the Netherlands, Russia and Turkey, providing for the free and open navigation of the Suez Canal "to every vessel of commerce or of war, without distinction of flag," the Powers agreed as follows (Article VIII): "The Agents in Egypt of the Signatory Powers of the Present Treaty shall be charged to watch over its execution. In case of any event threatening the security or the free passage of the Canal, they shall meet on the summons of three of their number under the presidency of their Doyen, in order to proceed to the necessary verifications. They shall inform the Khedivial Government of the danger which they may have perceived, in order that that Government may take proper steps to insure the protection and the free use of the Canal. Under any circumstances, they shall meet once a year to take note of the due execution of the Treaty.

* * * * *

"They shall especially demand the suppression of any work or the dispersion of any assemblage on either bank of the Canal, the object or effect of which might be to interfere with the liberty and the entire security of the navigation."

THE EGYPTIAN COMMISSION OF THE PUBLIC DEBT

Lord Cromer in his "Modern Egypt" (Vol. II, p. 304 *et seq.*) tells the story of the establishment of the Egyptian Commission of the Public Debt, consisting originally of an Englishman, a Frenchman, an Austrian, and an Italian, and later of a German and a Russian. The Powers of Europe having loaned nine million pounds, it was necessary to furnish security for the debt. For this purpose, the revenues of Egypt were pledged to the service of the debt and the commissioners were authorized to collect these revenues. No loan could be contracted without their consent. The Law of Liquidation passed by Egypt, coupled with the decree of July 27, 1885, gave to the European Powers participation in the judicial system (Cromer: "Modern Egypt," p. 316), all the Powers, without distinction, being represented upon the Courts of First Instance. "The choice of judges rests nominally with the Egyptian Government. In reality, the judges have until quite recently been nominated by their respective Governments" (p. 318). Lord Cromer, commenting upon this system in his chapter on "Internationalism," refers to the wide field for the development of internationalism of which the Egyptian Commission of the Public Debt furnishes an example. For "What can be more natural in cases of this kind," says he (p. 303), "than for the Powers to say — we are agreed as to all that is essential; certain points of detail remain to be settled locally; let us each appoint an expert who will represent our interests and see that they get fair play, but who at the same time will have no very marked political bias, and who will treat the technical questions which come under his consideration on their own merits?"

Sir Robert Phillimore points out that it frequently occurs that a state, having contracted pecuniary obligations toward another state, has mortgaged its revenues, or pledged a portion of its territory, as security for the payment of its debts. Thus, among the instances which he cites, the United Provinces of the Netherlands hypothecated Vlissingen, Rameken and Briel to England, in 1585. Denmark, in 1654, hypothecated the province of Holland to Sweden, as a security for the peace then concluded. Weimar appears to have been pawned, so to speak, to Mecklenburg in 1803, and Corsica by Genoa to France in 1768.

GENERAL PROVISIONS OF THE CONGRESS OF VIENNA

By the General Treaty of the Congress of Vienna, signed at Vienna June 9, 1815, Article XXX (30), the King of Prussia and the King of Hanover agreed:

"I. The Hanoverian Government engages to cause to be executed, at its expense, in the years 1815 and 1816, the works which a Commission, composed partly of artists, and to be immediately appointed by Prussia and Hanover, shall deem necessary to render navigable that part of the river Ems which extends from the Prussian frontier to its mouth, and to keep it, after the execution of such works, always in the same state in which those works shall have placed it for the benefit of navigation."

Article CVIII provided: "The Powers whose States are separated or crossed by the same navigable River engage to regulate, by common consent, all that regards its navigation. For this purpose they will name Commissioners, who shall assemble, at latest, within six months after the termination of the Congress, and who shall adopt, as the bases of their proceedings, the Principles established by the following Articles."

Article CIX: "The navigation of the Rivers, along their whole course, referred to in the preceding Article, from the point where each of them becomes navigable, to its mouth, shall be entirely free, and shall not, in respect to Commerce, be prohibited to any one; it being understood that the Regulations established with regard to the Police of this navigation shall be respected, as they will be framed alike for all, and as favourable as possible to the Commerce of all nations."

Article CX provides that the system for collection of duties and maintenance of the police "shall be, as nearly as possible, the same along the whole course of the River; and shall also extend, unless particular circumstances prevent it, to those of its Branches and Junctions, which, in their navigable course, separate or traverse different States."

THE SCHELDT

By the Treaty of London, November 15, 1831, between Great Britain, Austria, France, Prussia and Russia and Belgium, relating to the separation of Belgium from Holland, by Article IX it was provided that concerning the River Scheldt, "that the pilotage and the buoying of its channel, as well as the conservation of the channels of the Scheldt below Antwerp, shall be subject *to a joint superintendence; that this joint superintendence shall be exercised by Commissioners, to be appointed on both sides for this purpose; that moderate pilotage dues shall be fixed by mutual agreement; and that such dues shall be the same for the Dutch as for the Belgian Commerce.*" (British and Foreign State Papers, 1830–31, p. 653 *et seq.*) By Article X, "The use of the canals which traverse both Countries shall continue to be free and common to the Inhabitants of both."

THE NIGER AND THE CONGO

The Treaty of Berlin, February 26, 1885 (Vol. 76, British and Foreign State Papers), between Great Britain, Austria-Hungary, Belgium, Denmark, France, Germany, Italy, the Netherlands, Portugal, Russia, Spain, Sweden, Norway, Turkey and the United States, respecting the affairs of Africa, established the freedom of navigation of these rivers, and provided for the creation (Article XVII) of the International Navigation Commission of the Congo, which "shall be charged with supervising the application of the principles proclaimed and perpetuated (consacrés) by this declaration.

"In all cases of difference arising relative to the application of the principles established by the present Declaration, the Governments concerned may agree to appeal to the good offices of the International Commission, by submitting to it an examination of the facts which shall have occasioned these differences." (Hertslet's "Commercial Treaties," London, 1890, Vol. XVII.)

THE RHINE

By the Treaty of Vienna, June 9, 1815 (see Hertslet's "Collection of Treaties and Conventions between Great Britain and Foreign Powers," Vol. 1, 1827), Article X of Annex 16 provided that in order to insure that the navigation of the rivers along their whole course, referred to in the preceding article, "shall be entirely free, and shall not, in respect to Commerce, be prohibited to any one" and "* * * to establish a perfect control over the observance of the general regulation, and to constitute an authority which may serve as a means of communication between the States of the Rhine upon all subjects relating to Navigation, a Central Commission shall be appointed." Each State bordering on the Rhine (Article XI) was authorized to name a commissioner for its formation, which was to assemble regularly at Mentz on the 1st of November in each year. (The Congress was representative of Austria, France, Great Britain, Portugal, Prussia, Russia, Spain and Sweden.) Article XII provided that "in order that a permanent authority may exist, which, in the absence of the Central Commission, may superintend the observance of the regulation, and to which the merchants and boatmen may at all times refer, there shall be named a Chief Inspector and three Deputy Inspectors." Articles XIII, XIV and XV provided in detail for the manner of selection of the Chief Inspector by the Central Commission. It was provided that the Prussian commissioner should have one-third of a certain number of votes, the French commissioner one-sixth, the commissioner of the Netherlands one-sixth and the other German princes, excepting Prussia, one-third. The appointments of the inspectors were to be for life. The Chief Inspector, assisted by the Deputy Inspectors (Article XV), "are to superintend the fulfillment of the regulation, and to arrange everything relating to the police of the navigation. It will, therefore, be his right and his duty to issue orders on this subject to the Offices for collecting duties, and to communicate with the other local authorities of the States bordering on the Rhine." By Article XVI, the inspectors are to be under the control of the Central Commission, to whom they must report, and were subject in all respects to their superintendence. And by Article XVII, "The decisions of the Central Commission shall be had by an absolute majority of votes, which shall be given in perfect equality; but as its members should be considered as agents of the States of the Rhine, charged with making arrangements for their mutual interests, their decisions shall not be binding upon these States until their consent shall have been given by their Commissioners." By Article XXVII provision is made for the making of detailed regulations, as well as for organizing "judicial authorities of the First and Second Instance, and their mode of proceeding," "the Police of the ports for shipping, unloading, or shifting cargoes," all of which are to be framed by the Central Commission.

And by additional articles the same principles, it was stipulated, should be applied to the Neckar, the Mayne, the Moselle, the Meuse and the Scheldt.

THE FRENCH FISHING RIGHTS AT NEWFOUNDLAND

The ownership of Newfoundland was at one time a matter of dispute between Great Britain and France. By the Treaty of Utrecht in 1713, France ceded all her claims to Great Britain, subject, however, to the provision that "it shall be allowed to the Subjects of France, to catch fish and to dry them on land, in that part only, and in no other besides that, of the said Island of Newfoundland, which stretches from the place called Cape Bonavista, to the northern point of the said Island, and from thence running down by the western side, reaches as far as the place called Point Riche." By the treaty between Great Britain and France in 1783, the territorial limitations were changed, and by the Treaty of January 14, 1857, Article I (see U. S. Case, North Atlantic Fisheries Case before the Hague Tribunal, Vol. 2, Appendix, p. 51 *et seq.*) French subjects were confirmed in the "exclusive right to fish, and to use the strand for fishery purposes, during the season elsewhere specified (Article VIII), on the east coast of Newfoundland, from Cape St. John to the Quirpon Islands. They shall also have the right to fish, and to use the strand for fishery purposes, during the said season, to the exclusion of British subjects, on the north coast of Newfoundland, from the Quirpon Islands to Cape Norman; and on the west coast, in and upon the five fishing-harbours of Port-au-Choix, Small Harbour (or Petit Port), Port au Port, Red Island, and Cod Roy Island. Such exclusive fishing, from the Quirpon Islands to Cape Norman, shall extend to a distance of three marine miles * * * from * * * and as regards the five harbours, shall extend to within a radius of three marine miles in all directions from the centre of each such harbour, but with power to the Commissioners or Umpire elsewhere provided for in this Convention to alter such limits for each harbour in accordance with the existing practice." For the enforcement of these provisions, the naval officers of the French Government (Article IX) were authorized to enforce "the said French exclusive rights of fishing" by "expulsion of vessels or boats attempting concurrent fishing, in the case of there being no British cruizing-vessel in sight, or made known to be present, within a distance of five marine miles." Article XVIII provided for an arbitration commission, consisting of one commissioner for each Power, with provision for an umpire to settle disputes. These treaty rights remained in force and effect until April 8, 1904, when France limited her advantages in exchange for other rights in Africa, retaining, however, the fishing rights in these territorial waters. (See 2 North Atlantic Coast Fisheries Case, p. 83 *et seq.*)

Despagnet, a leading French writer, in his work, "Cours de Droit International Public," 1899 (see "Coastal Waters," English translations compiled by Borchard, p. 59), says:

"A state may cede to another the right of fishing in territorial seas, even to the exclusion of its own nationals. Such is the case in Newfoundland. Although fishing is free on the Grand Banks of Newfoundland situated in the open sea, and although it belongs exclusively to the French in the territorial waters of her colonies of St. Pierre and Miquelon, it is by exception reserved to France over a part of the territorial waters of Newfoundland, with liberty for French fishermen to establish themselves exclusively on the portion of the shore called, on that account, the French shore, by the Treaty of Utrecht of April 11, 1713, which ceded the island to Great Britain. This reservation has been confirmed in the treaty of Aix-la-Chappelle, 1748, and the treaty of Paris of February 10, 1763, of Versailles of September 30, 1783, of Paris of May 30, 1814, and November 20, 1815, and in the special convention regulating the exercise of fishing of January 14, 1857." (Section 422.)

Rivier, another French writer (see Borchard: "Coastal Waters," English translation, p. 319), says: "The most well known and important derogations from the exclusive right of fishing in the littoral sea is the servitude constituted in favor of France by Article XIII of the treaty of Utrecht of 1713, ceding Newfoundland to Great Britain and the servitude in favor of the United States in the British waters off Newfoundland and Canada."

The significant fact about the French fishing rights is that they are rights in waters over which Great Britain retains sovereignty, which, during certain periods of the year, may be exercised *exclusively* by Frenchmen.

OTHER FISHERY CASES

By Article XI of the treaty of peace between Russia and Japan, August 23, September 5, 1905, Japanese subjects receive a concession of fishing rights in Russian territorial waters of the Seas of Japan, Okhotsk, and Behring.

UNITED STATES-CANADIAN CANALS

By the Treaty of 1871 between the United States and Great Britain, the citizens of the United States are given free use "of the Welland, St. Lawrence, and other canals in the Dominion on terms of equality with the inhabitants of the Dominion; and the Government of the United States engages that the subjects of Her Britannic Majesty shall enjoy the use of the St. Clair Flats Canal on terms of equality with the inhabitants of the United States."

In our treaty with Great Britain (the reciprocity treaty) of 1854, "It is agreed that the citizens and inhabitants of The United States shall have the right to navigate the river St. Lawrence and the canals in Canada, used as the means of communicating between the Great Lakes and the Atlantic Ocean, with their vessels, boats, and crafts, as fully and freely as the subjects of Her Brittanic Majesty, subject only to the same tolls and other assessments as now are or may hereafter be exacted of Her Majesty's said subjects * * *

"It is further agreed, that British subjects shall have the right freely to navigate Lake Michigan with their vessels, boats and crafts, so long as the privilege of navigating the river St. Lawrence, secured to American citizens by the above clause of the present Article, shall continue; and the Government of The United States further engages to urge upon the State Governments to secure to the subjects of Her Britannic Majesty the use of the several State canals on terms of equality with the inhabitants of The United States."

NICARAGUA CANAL

By the treaty between the United States and Nicaragua in 1867 it was provided that: "The Republic of Nicaragua hereby grants to The United States, and to their citizens and property, the right of transit between the Atlantic and Pacific Oceans through the territory of that Republic, on any route of communication, natural or artificial, whether by land or water, which may now or hereafter exist or be constructed under the authority of Nicaragua, to be used and enjoyed in the same manner and upon equal terms by both Republics and their respective citizens."

UNITED STATES-MEXICO COMMISSION

In 1896 the United States and Mexico referred to "The International (Water) Boundary Commission" the subject of the equitable distribution of the waters of the Rio Grande (see Vol. II, Department of State, Proceedings of the International (Water) Boundary Commission, U. S. and Mexico, Treaties of 1884 and 1889). Among other things, the Commission was to report as to "the best and most feasible mode, whether through a dam to be constructed across the Rio Grande near El Paso, Tex., or otherwise, of so regulating the use of the waters of said river as to secure to each country concerned and to its inhabitants their legal and equitable rights and interests in said waters." On November 25, 1896, after careful study, the Joint Commission thus appointed recommended to the two governments "that a treaty be entered into, as a final settlement of all questions past and future, regarding the distribution of the waters of the Rio Grande." This treaty was to involve the ceding by the United States to Mexico of a small tract of land, the construction of a dam as designed by joint engineers, the removal of railroads from the bed of the proposed reservoir, the acquisition of land to be submerged, and required that the further management of the river should be committed to the management of a mixed commission, who, after constructing the dam, should provide for the permanent distribution of the flow, one-half, roughly speaking, for such use as the Mexican Government might see fit to apply it to, and one-half as the United States might see fit to apply it. The treaty between the United States and Mexico of March 1, 1889, provided that all questions arising by reason of the changes which take place in the beds of the Rio Grande and the Colorado Rivers should be submitted "for examination and decision to an International Boundary Commission which shall have exclusive jurisdiction in the case of said differences or questions." Under this power, the construction and limit of works undertaken on the Rio Grande and Colorado along the international boundary line has been freely exercised, notably in the case of the Brownsville and Matamoras jetties in 1895, where the commission recommended the construction of a complete system of defensive and counter-defensive works. (The Rio Grande is a torrential stream. For the greater part of the year it carries no great quantity of water. Then come its flood seasons, which come suddenly, do not last long and pass away quickly. To check these torrential flows "defensive and counter-defensive works" were required.) The International Commission in 1897 settled the matter of the demarcation of the boundary of the two international bridges connecting Eagle Pass, Texas, and Ciudad Porfirio Diaz, Coahuila. It also settled the boundary line in the El Chamizal case.

THE INTERNATIONAL JOINT COMMISSION (UNITED STATES AND CANADA)

Ex-Senator Root and Ex-Ambassador Bryce negotiated in 1909 the treaty relating to boundary waters between the United States and Canada which is now in full force and operation. This treaty provides (Article I) that "the navigation of all navigable boundary waters shall forever continue free and open for the purposes of commerce to the inhabitants and to the ships, vessels, and boats of both countries equally, subject, however, to any laws and regulations of either country, within its own territory, not inconsistent with such privilege of free navigation, and applying equally and without discrimination to the inhabitants, ships, vessels, and boats of both countries," both parties, however, reserving (Article II) "the exclusive jurisdiction and control over the use and diversion, whether temporary or permanent, of all waters on its own side of the line which in their natural channels would flow across the boundary or into boundary waters; *but it is agreed that any interference with or diversion from their natural channel of such waters on either side of the boundary, resulting in any injury on the other side of the boundary, shall give rise to the same rights and entitle the injured parties to the same legal remedies as if such injury took place in the country where such diversion or interference occurs.*"

By Article VII, "The High Contracting Parties agree to establish and maintain an International Joint Commission of the United States and Canada, composed of six commissioners, three on the part of the United States, appointed by the President thereof, and three on the part of the United Kingdom, appointed by His Majesty on the recommendation of the Governor in Council of the Dominion of Canada."

By Article VIII the Commission is given jurisdiction over and is required to pass upon all cases involving the use or obstruction or diversion of the waters with respect to which, under Articles III and IV of the treaty, the approval of the Commission is required. In passing upon such cases the Commission is required to govern itself by the following rules and principles:

"The High Contracting Parties shall have, each on its own side of the boundary, equal and similar rights in the use of the waters hereinbefore defined as boundary waters.

"The following order of precedence shall be observed among the various uses enumerated hereinafter for these waters, and no use shall be permitted which tends materially to conflict with or restrain any other use which is given preference over it in this order of precedence:

"(1) Uses for domestic and sanitary purposes;

"(2) Uses for navigation, including the service of canals for the purposes of navigation;

"(3) Uses for power and for irrigation purposes.

"The foregoing provisions shall not apply to or disturb any existing uses of boundary waters on either side of the boundary."

Furthermore, and this is of very great practical importance and of direct application to our problem, the Commission "may make its approval in any case *conditional upon the construction of remedial or protective works* to compensate, so far as possible, for the particular use or diversion proposed, and in such cases may require that suitable and adequate provision, approved by the Commission, be made for the protection and indemnity against injury of any interests on either side of the boundary."

Pursuant to this treaty, commissioners were appointed on the part of the United States on March 9, 1911, and on the part of Canada, November 10, 1911, organized on the 10th of January, 1912, and adopted rules of procedure (a copy of which is to be found in the library of the Commission). Under this authority, the Commission has acted in many cases, notably the Watrous Island Boom Company application for the approval of plans for a boom in Rainy River, the application of the Receiver of Michigan Lake Superior Power Company for approval of a lease with the United States for diversion of water and the construction of compensating works, the application of the Michigan Northern Power Company for diversion of waters of St. Mary's River at Sault Ste. Marie, Michigan, the application of the Algoma Steel Corporation, Limited, for approval of the construction of compensating works on St. Mary's River. Upon the hearing of the latter application, the Chairman, Hon. James A. Tawney, said: "* * * the people of no two countries in the world, except the people of Canada and the United States, have the opportunity of appearing personally before an international tribunal of any kind with original and final jurisdiction in their respective countries, as they may and are now doing in this case * * * This tribunal is also unique because composed of citizens of two independent sovereignties. * * * Neither section of the Commission has any authority under the treaty to act in either country independent of the other. *Each section acts in conjunction with the other as a joint international organization.* In cases like the one now before us each member acts as the representative of *both countries,* or as Mr. Commissioner Gore, of Massachusetts, in deciding a case arising under the Jay treaty for the settlement of questions growing out of the War of the Revolution, well said:

"'Although I am a citizen of but one nation, I am constituted a judge of both. Each nation has the same right and no greater right to demand of me fidelity and diligence in the examination, exactness, and justice of the decision.' "

This is precisely the attitude that we should like a Joint Port Authority to take, though receiving appointment, one-half of its members at the hands of the Governor of New York and one-half at the hands of the Governor of New Jersey. The considerations leading to the formation of this International Commission are pertinent to our inquiry. In the opinion of the Joint High Commission in the matter of the compensating works in St. Mary's River, it said:

"Neither Government needed the aid of the Commission to prevent it from acting improvidently in granting persons or corporations authority to use, obstruct, or divert its navigable waters. They were fully capable of taking care of themselves. *But in taking care of themselves on their own side of the line, they did not always consider, or at least did not always adequately provide for taking care of, the interests of their neighbor on the other side of the line.* It was this feature of the situation that led to the establishment of the International Joint Commission. That Commission, so long as the treaty remains, *supervises the action of either Government acting singly and alone in the matter of uses, obstructions, or diversions of boundary waters authorized by it, but it does so, not for the protection of the moving government, but for the protection of the passive government, which may be injured by the energy of its neighbor acting within the scope of its municipal authority, if its power be not scrutinized and supervised by an impartial tribunal.*"

The employment of a joint agency to construct "compensating work" finds precedential authority in the opinion of the Joint High Commission in the matter of the application of the Michigan Northern Power Company for approval of diversion and use of the waters of the St. Mary's river on the United States side of the international boundary at Sault Ste. Marie. In its opinion and order, the Joint High Commission directed that compensating works, including power canals, should be built to maintain the level of Lake Superior, but provided that "the operation of all the said works, canals, head gates and by-passes for the above purposes shall be under the direct control of * * * 'the board of control.' " This board of control consists of two members, one appointed by each government, which board is authorized to formulate the rules under which the compensating works, the power canals, their head gates and by-passes are to be operated, "so as to secure as nearly as may be the regulation of Lake Superior within the range of monthly mean levels recommended and found necessary." In this opinion, the Commission considers its power to create such boards of control and finds that it is not only confirmed by the treaty, "but its existence is a necessary concomitant to the carrying out of the true intent and purpose of the treaty in respect to the prevention and settlement of disputes between the two governments and their people regarding the use of boundary waters. Without this power to approve conditionally, in cases where the proposed obstructions and diversions affect the rights and interests of the people on the other side, the purpose of the treaty would entirely fail." And the Commission adopts the language of Judge Brown in *Tucker* v. *Alexandroff* (183 U. S. 424) to the effect that "treaties are solemn engagements entered into between independent nations for the common development of their interests and the interests of civilization." Not only are they designed to avoid war and secure a lasting and perpetual peace, but they are designed (as our proposal is designed) to promote a friendly feeling between the people of the two countries (States). For this reason "they should be interpreted in that broad and liberal spirit which is calculated to make for the existence of a perpetual amity, so far as it can be done without the sacrifice of individual rights or of those principles of personal liberty which lie at the foundation of our jurisprudence." Accordingly, the Joint High Commission, interpreting the treaty in this broad spirit, finds that "there are no limitations whatsoever except the judgment of the Commission" as to what "may be necessary to suitably and adequately protect and indemnify all interests." Thus, to avoid any possible injury to large public and private interests on both sides of the river, it established the joint board of control and finds it "unnecessary to consider the question of whether, under the treaty, the commission has or has not administrative or executive powers." It holds that in exercising the judicial powers given to it by the treaty, it may make the grant of permission conditional upon the construction of works to be supervised by an international board of control. In its order it provides that this board of control is to be made up of the officer of the Corps of Engineers charged with the improvement of the falls of St. Mary's River on the American side, and an officer appointed by the Canadian Government. It is made the duty of these two "to formulate rules under which the compensating works and power canals and their head gates and by-passes shall be operated so as to secure as nearly as may be the regulation of Lake Superior." And by paragraph 17, in case this board cannot agree, the Commission itself will make the decision. Other applications, involving the construction of compensating works, were treated by the Commission in the same way. Thus the application of the St. Croix Water Power Co., incorporated by C. 203, Acts of 1899, of Maine, and the Sprague's Falls Manufacturing Co. (Ltd.), incorporated 2 Edw. VII, C. 108, Dom. Can., for the construction of a dam across the St. Croix River at Grand Falls, and a power canal to convey water to a power house, was approved on condition that all dams, sluices, by-passes, etc., shall be "under the direct control" of the Board of Control consisting of an officer to be appointed by the Governor-General in Council of Canada and one appointed by the Secretary of War of the United States, with full power to make rules, preserve records, and, in case of disagreement, to refer the matter to the Joint High Commission for final decision. The remarks of Commissioner Magrath in concurring with the decision in this case have value for us. He wishes to point out that "while not strictly pertinent to the matter before the commission, the practice by Governments of making grants of land carrying riparian rights in streams was initiated when these rights were not looked upon as being of much value, and unfortunately the practice has outlived the old condition of things. In recent years, however, owing largely to electrical transmission, power rights have acquired great importance and may properly be regarded as public utilities. It would be well for all Legislatures of both the United States and Canada to consider the desirability of retaining or acquiring these valuable assets for the benefit of the public."

THE LAKE OF THE WOODS CASE

What the Port of New York is to the States of New York and New Jersey, the watershed of the Lake of the Woods is to Minnesota, Manitoba and Ontario. It is 1,485 square miles in area, or about 400 square miles greater than the State of Rhode Island. The entire drainage area of the lake and its tributary waters is 26,750 square miles, an area 5,000 square miles greater than Nova Scotia, and greater than the combined areas of New Hampshire, Massachusetts, Rhode Island, Connecticut and Delaware. The lake on the map appears as only a small water between Lake Winnepeg, Canada, and Lake Superior, United States. It is the westerly point of the water boundary between the United States and Canada. But upon its rise and fall largely depends the commercial and agricultural prosperity of these communities in Canada and in the United States. In 1895, settlers on the south shore of the lake, in Minnesota, began to complain to the Department of the Interior that their lands had been submerged by high levels in Lake of the Woods, caused by the construction of a dam, and these complaints continued down to and including 1905 and 1906. The situation having grown worse, and investigation having been made both by the War Department of our country and a Canadian Government committee, the question was raised, "what rights and remedies the citizens of Minnesota will have" with regard to "diversion of these waters" and what corresponding measures should be taken with a view to the establishment of similar rights and to provide similar remedies for citizens of Canada. Overtures were made by the United States to Canada to submit these questions to the International Joint Commission. It appeared that there was doubt as to whether or not the Commission had jurisdiction, and the rights of the parties were "not rights which either now possess. They are rights which belong to their respective inhabitants and, if not voluntarily granted, can be acquired only for the purposes desired, by and through the exercise of the sovereign power to take private property for a public use." After a most painstaking engineering investigation into the whole problem, covering many volumes, the International Joint High Commission recommends that for the purpose of securing the most advantageous use of the waters of this entire watershed, and also from the standpoint of a sound, comprehensive international policy, the International Joint Commission "be authorized to exercise supervision and control over the operation of all dams and regulating works extending across the international boundary * * *" And further, that, "as a matter of sound international policy, neither Government should permit the permanent or temporary diversion out of the watershed of any waters within its jurisdiction which are tributary to the boundary waters under consideration," and which would result in any injury on the other side of the boundary, without the approval of the International Joint Commission, and that the decision of the Commission in all such cases be made final. The Commission was required to consider "by what means or arrangement can the proper construction and operation of regulating works or a system or method of regulation be best secured and maintained in order to insure the adequate protection and development of all the interests involved on both sides of the boundary, with the least possible damage to all rights and interests, both public and private." In order to accomplish this task, the American Commissioners *recommend acquisition of private property*, and in their report *submit a definite plan of procedure* for the exercise of the powers of eminent domain in each of the two countries by which such private property may be acquired. They examine into the questions of law raised by these recommendations, and say that the use to which the property is to be put "would constitute a public use and authorize the taking of property for this use under the power of eminent domain and expropriation." Their observations upon the value of such a joint undertaking have value to us. "*The interdependent interests, the importance and value to both countries and their people of permanently securing all the material advantages from the use of these waters and preventing such use from hereafter being a disturbing factor between the two Governments, are of such magnitude that the rights acquired in respect thereto should be permanent and irrevocable. If acquired severally and thereafter held by the Government acquiring the same in trust for the benefit of the other the uncertainty of tenure would seriously impair the stability of these rights and probably constitute a barrier in the way of the development of the water powers of this region, because rights thus held could be renounced at will.*" They also consider the question of how the parties "can legally acquire and hold, under the jurisdiction of the other, these necessary vested rights in order to insure the satisfactory maximum water-power development in both countries this region affords, and at the same time safeguard the rights and promote the development of the interests of their respective peoples." They propound the question: "*Can a State in its public capacity hold nonterritorial property in another State or can a sovereign State limit or qualify its proprietary sovereignty by permitting another State to acquire and hold property within its territorial jurisdiction for the use and benefit of such other State within its jurisdiction or for the use and benefit of its inhabitants?*" After a careful review of authorities and the statement that "the doctrine here laid down is supported by all text writers on international law," they say: "The power of a nation to restrict its proprietary sovereignty by granting to another nation the right to acquire and hold title to land or vested rights or easements therein the same as if held by a private individual can not be questioned. Lands, rights, or easements thus acquired are held, however, subject to the political sovereignty of the nation granting the right to hold the same." For this statement they cite *Leavenworth R. R. Co.* v. *Howe,* 114 U. S. 525, 538. They are of opinion that this doctrine has been "universally recognized and followed by nations 'time out of mind' as appears from their treaties. The granting of this right, however, does not involve or carry *with it any surrender of political sovereignty. That remains unchanged and supreme.*" Further considering the question whether or not the two sovereignties could acquire property and thereafter hold it jointly, the American Commissioners say: "The rights, however, which both parties must have for this purpose are not rights which either now possess. They are rights which belong to their respective inhabitants and, if not vountarily granted, can be acquired only for the purpose desired, by and through the exercise of the sovereign power to take private property for a public use. Can this power, by agreement, be exercised jointly by the high contracting parties for this purpose?" Recognizing always that whatever procedure is adopted must conform to the fundamental law of each nation, and since the law in Canada and the United States emanates from the same common source and both are protected under the same or similar rules — in the United States under a written Constitution and in Canada under rules perhaps less rigid, and more flexible — therefore, in their belief the recommendation should conform to the requirements of the Constitution of the United States. If it so conforms, "it will not likely be found inconsistent with the laws governing the taking of private property in the Dominion of Canada." "The high contracting parties," say the American Commissioners, "each possess and may exercise the power of eminent domain or expropriation in their respective jurisdictions, for their own or the public good. It follows, therefore, that in their sovereign capacity, they may *by treaty agree to do jointly and for their mutual welfare, in their respective jurisdictions, that which they are authorized to do severally.*" Indeed, they find recognition of this principle in the treaty under which they are acting, by which the two nations have clothed the Joint High Commission with "final jurisdiction in both countries in certain matters which involve the rights, obligations, or interests of either in relation to the other, or to the inhabitants of the other." There is no doubt, therefore, in their opinion, that the two countries may conclude a treaty, providing for the institution of legal proceedings in either or both countries for the taking of private property, provided the purpose of the proposed taking is a public use, and that being so "*it is clearly within the power of the high contracting parties to authorize, by treaty, the making of a special administrative agreement between them for the complete accomplishment of the purposes of that treaty or of any part thereof.*" (These careful observations of the American Commissioners, though contained in a supplemental report, are in accord in the main with the formal recommendations for control made by the Joint Commission.) This determination by an international commission of Canadian and American lawyers, taking full account of the fundamental principles of the English common law and of the limitations of the Federal Constitution, seems to be a most convincing and satisfactory precedent to guide us in the formulation of our treaty.

THE EUROPEAN (DANUBE) COMMISSION

Of all the administrative agencies that have ever been created for the purpose of carrying out the common purpose of several sovereignties, especially in the development of rivers and harbors and the improvement of commerce and navigation, none is so instructive and so valuable in experience as the Danube Commission. Two recent English writers — "The Question of the Bosphorus and Dardanelles" — Phillipson and Buxton, London, 1917 — recommend as the model for the internationalization of the Bosphorus and the Dardanelles the method of internationalization of the Danube. "In many spheres of political and commercial activity," say they (p. 237), "international co-operation has conferred great benefits on all parties concerned." "A system of internationalisation means international co-operation. It is, then, manifestly in the interests of the world at large that every opportunity should be seized for internationalising territories that have given rise to inveterate disputes, as well as waterways that are used for general international commerce and intercourse. To bring about the co-operation of States in this or that undertaking is to promote the habit of association, and to pave the way for a more thorough and comprehensive union, such as is implied in the establishment of a League of Nations subject, in the event of differences, to the arbitrament of an International Court." The European Commission for the Danube (p. 241) "has achieved such success that it may be regarded as a remarkable precursor in the art of international government." The Danube played a very important part in European policy and political economy even before the present war. It traverses regions "whose rich agriculture is proverbial" (Le Danube, Baicoianu, Paris, 1917) and its great importance economically and commercially arises from the diversity of the production along its banks. It finds its source in the Grand Duchy of Baden, a distance of thirty to forty kilometers from the approach to the Rhine and about 500 to 600 kilometers "de la Mer du Nord" (North Sea). It travels through Wurtemburg and Bavaria, its branch, the Enns, dividing Lower from Upper Austria. It passes the cities of Linz and Vienna. It then takes a right oblique to the south and goes through the great fields of Hungary, passing Budapest, dividing Slavonia from Hungary. Near the Theiss it changes its direction to the southeast, touching the city of Semlin, at which point commences the front of Servia. The Danube then passes Belgrade between Servia on the south and Hungary on the north and enters Rumania, nourishing the basin between the Carpathians and the Balkans, separating Dobrudja from Bessarabia. For a distance of 400 kilometers it is the frontier between Rumania and Bulgaria, and enters the Black Sea through three mouths, the Kilia, Sulina and St. George. It travels through nine countries, having a population of 52,783,472. (Baicoianu.)

Of course, the improvement of the navigability of the Danube is of great importance to all of the countries it traverses, but the Associated Chambers of Commerce of the United Kingdom, addressing the Secretary of State for Foreign Affairs, the Right Honorable Earl Granville, K. G., on April 27, 1882, said, "it is of great importance to the trade and commerce of this country [Great Britain] that the navigation of the River Danube should be as free as possible, and that British ships, as well as the vessels of other maritime nations, should be allowed to move and carry cargo to and from, and between, all the ports on that river with the same freedom and on the same terms and conditions as vessels belonging to States having territory bordering on the river." (Parliamentary Papers, 1882, Vol. LXXX, London, 1882.) The tonnage leaving Sulina in 1881 amounted to 793,454 tons. The annual receipts in 1881 were Fr. 3,448,190, c. 60. The expenses were Fr. 2,606,095, c. 39. Statistics of the expenditure, debt, sinking fund, etc., are to be found in this volume, as well as in Baicoianu. (See also Encyclopædia Britannica, 11th Edition, title "Danube," p. 819 et seq.)

The history of the various European controversies over the Danube is told by Baicoianu at length, and an excellent map showing in colors the several sovereign States through which the Danube runs and the effect of the several treaties of Paris, 1856, Berlin, 1878, and of London, 1883, is to be found attached to the book of Geffcken (Berlin, 1883), "La Question du Danube."

The European convulsion of 1853, resulting in the Treaty of Paris (1856), afforded an opportunity for the harmonization of the political and economic questions affected by the Danube, and a convenient grouping of a considerable number of states. The principle emphasized by Grotius and expounded more fully by Vattel and other jurists, that navigation of international rivers should be free, was proclaimed in November, 1792, by the Provisional Executive Council of France in regard to the Scheldt. This proclamation has been designated "the first charter of contemporary fluvial liberties." (E. Engelhardt: "Du régime conventionnel des fleuves internationaux," Paris, 1879.) In 1814, the Treaty of Paris (Art. V) declared the freedom of navigation on the Scheldt, and on the Rhine from the point at which it becomes navigable to the sea. The following year the final act of the Congress of Vienna stipulated that "the Powers whose States are separated or crossed by the same navigable River engage to regulate, by common consent, all that regards its navigation." And they agreed to the appointment of a commission which should assemble within six months thereafter and which should follow the basic principle established by the article. Article CIX laid down this fundamental principle and said that "the navigation of the Rivers, along their whole course, referred to in the preceding Article, from the point where each of them becomes navigable, to its mouth, shall be entirely free, and shall not, in respect to Commerce, be prohibited to any one; it being understood that the Regulations established with regard to the Police of this navigation shall be respected, as they will be framed alike for all, and as favourable as possible to the Commerce of all nations." Article CX provides that the system for collection of duties and maintenance of the police "shall be, as nearly as possible, the same along the whole course of the River; and shall also extend, unless particular circumstances prevent it, to those of its Branches and Junctions, which, in their navigable course, separate or traverse different States."

To control the navigation, and as a means of communication between the states of the Rhine, it was agreed that a central commission should be appointed, comprising delegates named by the various bordering states. The Treaty of Paris come to between Great Britain, Austria, France, Prussia, Russia, Sardinia and Turkey (March 30, 1856) provided as follows:

"Art. XV. The Act of the Congress of Vienna having established the principles intended to regulate the Navigation of Rivers which separate or traverse different States, the Contracting Powers stipulate among themselves that those principles shall in future be equally applied to the Danube and its Mouths. They declare that its arrangement henceforth forms a part of the Public Law of Europe, and take it under their Guarantee.

"The navigation of the Danube cannot be subjected to any impediment or charge not expressly provided for by the Stipulations contained in the following Articles: In consequence, there shall not be levied any Toll founded solely upon the fact of the Navigation of the River, nor any Duty upon the Goods which may be on board of Vessels. The Regulations of Police and of Quarantine to be established for the safety of the States separated or traversed by that River, shall be so framed as to facilitate, as much as possible, the passage of Vessels. With the exception of such Regulations, no obstacle whatever shall be opposed to Free Navigation.

"Article XVI. With the view to carry out the arrangements of the preceding Article, a Commission, in which Great Britain, Austria, France, Prussia, Russia, Sardinia, and Turkey, shall each be represented by one delegate, shall be charged to designate and to cause to be executed the Works necessary below Iskatcha, to clear the Mouths of the Danube, as well as the neighboring parts of the Sea, from the sands and other impediments which obstruct them, in order to put that part of the River and the said parts of the Sea in the best possible state for Navigation.

"In order to cover the Expenses of such Works, as well as of the establishments intended to secure and to facilitate the Navigation at the Mouths of the Danube, fixed Duties, of a suitable rate, settled by the Commission by a majority of votes, may be levied, on the express condition that, in this respect as in every other, the Flags of all Nations shall be treated on the footing of perfect equality."

By Article XVII a commission is established to be composed of delegates from Austria, Bavaria, the Sublime Porte, and Wurtemburg (one for each of these Powers), to whom are to be added commissioners from the three Danubian Principalities, which nomination shall have been approved by the Porte. "This Commission, which shall be permanent: 1, Shall prepare Regulations of Navigation and River Police; 2. Shall remove the impediments, of whatever nature they may be, which still prevent the application to the Danube of the Arrangements of the Treaty of Vienna; 3, Shall order and cause to be executed the necessary Works throughout the whole course of the River; and 4. Shall, after the dissolution of the European Commission, see to maintaining the Mouths of the Danube and the neighboring parts of the Sea in a navigable state."

"Art. XVIII. It is understood that the European Commission shall have completed its task, and that the River Commission shall have finished the Works described in the preceding Article, under Nos. 1 and 2, within the period of two years. The signing Powers assembled in Conference having been informed of that fact, shall, after having placed it on record, pronounce the Dissolution of the European Commission, and from that time the permanent River Commission shall enjoy the same powers as those with which the European Commission shall have until then been vested.

"Art. XIX. In order to insure the execution of the Regulations which shall have been established by common agreement, in conformity with the principles above declared, each of the Contracting Powers shall have the right to station, at all times, Two Light Vessels at the Mouths of the Danube."

In 1865, the European Commission created by the treaties (see Vol. XII, Hertslet's "Treaties," p. 884) having succeeded "after nine years' work in realizing important improvements in the system of navigation — notably, by the construction of two piers at the mouth of the Sulina branch, which have had the effect of admitting into this ambouchure vessels of a large draught of water — by the execution of works of correction and cleansing in the course of the same branch — by raising wrecks, and establishing a system of buoys — by the erection of a lighthouse at the mouth of the St. George — by the institution of a regular life boat service, and by the creation of a seaman's hospital at Sulina — lastly, by the provisional regulation of the different services connected with the navigation between Iskatcha and the sea;" the Powers, representing Great Britain, Austria, France, Italy, Prussia, Russia and Turkey, do ratify and establish the rights of the parties by the succeeding articles. Article I provides that all the works and establishments "shall continue to be devoted exclusively to the use of the navigation of the Danube, and can never be turned aside from this object for any motive whatever; *to this end they are placed under the guarantee and protection of international law.*" By the same Article, the European Commission "shall continue charged, to the exclusion of all interference whatever, to administer these works and establishments for the advantage of the navigation, to watch over their maintenance and preservation, and to give to them all the development that the requirements of the navigation may demand." By Article II there is "specially reserved to the European Commission, or to the authority that shall succeed it, the power to design and cause to be carried out all the works that may be deemed necessary, in the event of its being wished to render permanent the improvements, until now of a temporary character, in the branch and at the mouth of the Sulina, and to prolong the piers at this mouth according as the state of the Bar Channel may require it."

By Article VI it is provided "that on neither bank of the river, either in the port of Sulina or St. George, shall there be constructed either by the territorial authorities, by commercial or navigation companies, or by private individuals, any landing jetties, quays, or other establishments of the same nature, of which the plans have not been communicated to the European Commission, and recognized as being in conformity with the general plan of the quays, and as tending in no wise to compromise the effect of the works of improvement."

By Article VIII administrative power is vested in an Inspector-General of the Lower Danube and the Captain of the Port of Sulina. Annexed to these articles is a code governing the policing of the Sulina Roads and Port, regulations for vessels crossing and passing one another, towage rules, discharge of ballast, lighterage, etc., etc., with a chapter of penalties resembling a very substantial section of our Penal Code. Phillipson and Buxton ("The Question of the Bosphorus and Dardanelles," p. 245) say that this institution is "unprecedented in international law and usage" and is "a kind of European syndicate, enjoying practically full independence and exercising many functions attaching to sovereignty." Demorgny, a French writer ("La Question du Danube," Paris, 1911, p. 176) also refers to this Commission as a sort of temporary embodiment of sovereignty granted to it in the interest of humanity in general, having administrative, executive, legislative and judicial power. Say Phillipson and Buxton: "Indeed * * * in many respects [it] is in the position of an autonomous State." It is not amenable to the jurisdiction of Rumania, through whose territory it goes. It may negotiate without intermediary with neighboring states. It has a treasury derived from the tolls which it collects for the use of the works which it has built. It publishes its budget in every country that it represents. It possesses a flotilla which flies its own distinctive flag. It may contract loans and dispose of lands. It is both a deliberative and an executive body. It has the power to examine any matter whatever relating to navigation on the Danube and legislates police regulations, shipping rules, tariff scales, plans of necessary works, etc., and its resolutions carried by a majority of votes become law. As an executive body it carries its own decisions into operation. To accomplish this, it employs a staff of specialists. It punishes violations of its own rules and regulations, and as a supreme tribunal reviews the judgments pronounced by the Navigation Inspector or the Superintendent of the Port of Sulina, who are the judges of first instance. The light vessels of the Powers stationed at the mouth of the Danube are the police force to secure the execution of the legislative, executive and judicial decisions of this Commission.

In 1865, as we have seen, the works and establishments of the Commission were declared to be neutralized so as to be immune from attack in case of war. At the Conference in Paris in 1866, its term was extended for five years. By the Treaty of London, 1871, Russia was allowed to maintain a fleet in the Black Sea, but the neutrality of the European Commission was protected by additional guarantees. Its powers were then extended, also, for twelve years. In the Russo-Turkish War of 1877, the operations of the belligerents interfered with the free navigation of the Danube, and complaints were made against them, but it seems to have been held that the transactions relating to the river did not entirely make of it a neutral zone and imposed upon belligerents merely the duty to respect the works and establishments of the Commission, to impede the navigation as little as possible, and to restore it as quickly as possible in case of any interference with it. Nevertheless, by the treaty of Berlin of 1878, all fortresses between the Iron Gates and the sea were to be demolished, no new ones were to be constructed, and within these limits no warships other than light vessels used for police and custom purposes were to navigate the river. At this time Rumania, having been made independent, was given representation in the Commission and its sphere of operations was extended to Galatz. By the subsequent treaties of 1883 and 1904, the authority of the Commission was renewed and enlarged. By the treaty of 1904, provision was made for its continuance for successive periods of three years, but reserved to each of the eight States represented the right to dissolve the treaty by giving notice a year before the termination of the triennial period.

Germany during the recent war, having subjugated Rumania, negotiated a "peace" by which she eliminated entirely the Entente Powers from any further participation in the Danube Commission, changed the Commission into the "Danube Mouth Commission," continuing it "as a permanent institution with the powers, privileges, and obligations hitherto appertaining to it," but limiting its organization to "representatives of the States situated on the Danube or the European coasts of the Black Sea." (See Treaty of Bucharest, signed May 7th, in "The New Europe," Vol. VII, No. 85, May 30, 1918, at p. 166.) On the 19th of May the Entente Ministers informed the Rumanian Government that they did not recognize that portion of the treaty which dealt with the navigation of the Danube (idem, p. 166). Nevertheless, even Germany recognizes the principle and effectiveness of internationalization of ports and rivers in this Treaty of Bucharest. The system and method is continued, though the participating Powers are changed.

Sir Charles Hartley, Chief Engineer of the European Danube Commission from 1856 to 1907, in a paper contributed to the Institution of Civil Engineers in 1873 (Vol. XXXVI) (see Encyclopædia Britannica, 11th edition, title "Danube," p. 822) gave a graphic description of the state of the Sulina mouth when the Commission began its work in 1856. "The entrance to the Sulina branch," said he, "was a wild open seaboard strewn with wrecks, the hulls and masts of which, sticking out of the submerged sandbanks, gave to mariners the only guide where the deepest channel was to be found. The depth of the channel varied from 7 to 11 feet, and was rarely more than 9 feet.

"The site now occupied by wide quays extending several miles in length was then entirely covered with water when the sea rose a few inches above ordinary level, and that even in a perfect calm; the banks of the river near the mouth were only indicated by clusters of wretched hovels built on piles and by narrow patches of sand skirted by tall weeds, the only vegetable product of the vast swamps beyond."

Prior to the time when the great improvements were made an average of only 2,000 vessels, with a tonnage capacity of 400,000 tons, visited the Danube, and of this number more than three-fourths loaded either the whole or part of their cargoes from lighters in the Sulina roadstead, where, "lying off a lee shore, they were frequently exposed to the greatest danger." "Shipwrecks," says Sir Charles Hartley, "were of common occurrence, and occasionally the number of disasters was appalling. One dark winter night in 1855, during a terrific gale, 24 sailing ships and 60 lighters went ashore off the mouth and upwards of 300 persons perished." The method by which all of the improvements have been made was by levying tolls upon the vessels entering the Danube. By the Treaty of Galatz, April 30, 1868, Great Britain, Austria, France, Italy, Prussia and Turkey agreed to contract a loan for the completion of the works at Galatz. This loan was not to exceed £135,000. This loan was made September 29, 1868, through Messrs. Bischoffsheim and Goldschmidt, and was paid off in full prior to January 15, 1884, all the nations interested in guaranteeing the loan being thus relieved of further liability. (See Declaration by Percy Sanderson, Her Majesty's Commissioner for the Danube, Vol. XVII, Hertslet's "Commercial Treaties," p. 1039.) The Commission now has an average annual income of about £80,000 derived from taxes paid by ships when leaving the river. The normal annual expenditure amounts to £56,000, while £24,000 is generally allotted to extraordinary works, such as new cuttings. (See Encyclopædia Britannica, 11th edition, title "Danube," p. 823.) Between 1857 and 1905 over one and three-quarter million pounds sterling were spent on engineering works, including the construction of quays, lighthouses, workshops and buildings, and from being a collection of mud hovels Sulina has grown into a town of 5,000 inhabitants, has a well organized hospital where all merchant sailors receive gratuitous treatment, lighthouses, quays, floating elevators, and an efficient pilot service, which all combine to make Sulina "a first-class port." (See Encyclopædia Britannica, 11th edition, title "Danube," p. 823.)

OTHER EXAMPLES OF INTERNATIONAL GOVERNMENT

Reinsch, in his "Public International Unions" (Ginn & Co., 1911), says: "* * * the realm of international organization is an accomplished fact." (Introduction, p. 4.) At that time (1911) there were already in existence over forty-five public international unions composed of states, of which thirty are provided with bureaus or commissions. These include unions for postal and telegraphic communications, and for improvement in the means and methods employed by them. "International co-operation," says Reinsch, "has become an absolute necessity to States, along all the various lines of national enterprise." Again (p. 137), Reinsch says: "International co-operation may, in the present state of our civilization, *be represented as an ethical duty*. No State has the right, by stubborn aloofness, * * * to exclude its citizens from the advantages of civilization. But this ethical duty is reenforced by a very practical necessity, which is plain to any common-sense administration."

"International Government" (1916), a recent book written for the purpose of establishing the practicability of an international authority to settle points of difference among nations, consists of a study made by L. S. Woolf and a committee of the Fabian Society, with an introduction by Bernard Shaw. Part II gives many examples of the internationalization of administration, reviewing the theory and experience of the *Universal Postal Union, the Telegraphic Union, the international control of wireless, of railways, of other means of communication, the international regulation of public health and the prevention of epidemic diseases, of international monetary unions, sugar commissions, etc., etc.*

It would unduly lengthen this report to discuss in detail the various legal phases of the instrumentalities that have been devised by governments, legislative, executive and judicial, to effect a common purpose. It has not been the purpose to make a complete resumé of all precedents upon the subject, but to make clear the legal theory and to cull those special precedents that have value in the framing of our interstate treaty and, in addition, perhaps fix guideposts for the determination of legal controversies that may hereafter arise.

We shall now briefly review the provisions of the Transportation Act of 1920 which bear upon our problem.

Provisions of the Transportation Act of 1920, Esch-Cummins Bill. Public No. 152. 66th Cong. Approved Feb. 28, 1920.

Under subdivision "C" of subsection 15 of section 402 of the Interstate Commerce Act, as amended by section 402 of the Transportation Act, the Interstate Commerce Commission is now authorized "*to require such joint or common use of terminals, including main-line track or tracks for a reasonable distance outside of such terminals, as in its opinion will best meet the emergency and serve the public interest, and upon such terms as between the carriers as they may agree upon, or, in the event of their disagreement, as the Commission may after subsequent hearing find to be just and reasonable*" and under subsection 16 the Commission may "make such just and reasonable directions with respect to the handling, routing, and movement of the traffic of such carrier and its distribution over other lines of roads, as in the opinion of the Commission will best promote the service in the interest of the public and the commerce of the people, *and upon such terms as between the carriers as they may agree upon, or, in the event of their disagreement, as the Commission may after subsequent hearing find to be just and reasonable*," and section 3 of the Interstate Commerce Act, subdivision 4, has been further amended so that "if the Commission finds it to be in the public interest and to be practicable, without substantially impairing the ability *of a carrier owning or entitled to the enjoyment of terminal facilities to handle its own business, it shall have power to require the use of any such terminal facilities, including main line track or tracks for a reasonable distance outside of such terminal, of any carrier, by another carrier or other carriers, on such terms and for such compensation as the carriers affected may agree upon, or, in the event of a failure to agree, as the Commission may fix as just and reasonable for the use so required, to be ascertained on the principle controlling compensation in condemnation proceedings. Such Compensation shall be paid or adequately secured before the enjoyment of the use may be commenced. If under this paragraph the use of such terminal facilities of any carrier is required to be given to another carrier or other carriers, and the carrier whose terminal facilities are required to be so used is not satisfied with the terms fixed for such use, or if the amount of compensation so fixed is not duly and promptly paid, the carrier whose terminal facilities have thus been required to be given to another carrier or other carriers shall be entitled to recover, by suit or action against such other carrier or carriers, proper damages for any injuries sustained by it as the result of compliance with such requirement, or just compensation for such use, or both, as the case may be.*"

Under section 412 of the Transportation Act, the two paragraphs under subdivision "a" of the thirteenth paragraph of section 6 of the Interstate Commerce Act are amended so as to read as follows:

"(a) To establish physical connection between the lines of the rail carrier and the dock at which interchange of passengers or property is to be made by directing the rail carrier to make suitable connection between its line and a track or tracks which have been constructed from the dock to the limits of the railroad right of way, or by directing *either or both the rail and water carrier, individually or in connection with one another, to construct and connect with the lines of the rail carrier a track or tracks to the dock.* The Commission shall have full authority to determine and prescribe the terms and conditions upon which these connecting tracks shall be operated, and it may, either in the construction or the operation of such tracks, determine what sum shall be paid to or by either carrier: *Provided*, That construction required by the Commission under the provisions of this paragraph shall be subject to the same restrictions as to findings of public convenience and necessity and other matters as is construction required under section 1 of this Act."

Under section 413 of the act, paragraph "c" of the thirteenth paragraph of section 6 of the Interstate Commerce Act is amended to read as follows:

"(c) To establish proportional rates, or maximum, or minimum, or maximum and minimum proportional rates, by rail to and from the ports to which the traffic is brought, or from which it is taken by the water carrier, and to determine to what traffic and in connection with what vessels and upon what terms and conditions such rates shall apply. By proportional rates are meant those which differ from the corresponding local rates to and from the port and which apply only to traffic which has been brought to the port or is carried from the port by a common carrier by water."

In the power to regulate rates under section 422 of the Transportation Act, a new section 15-a is added, by which the power to fix rates expressly excludes *inter* *alia* "any belt line railroad, terminal switching railroad, or other terminal facility, owned exclusively, and maintained, operated and controlled by any State or political subdivision thereof."

Section 500 of the act provides as follows:

"It is hereby declared to be the policy of Congress to promote, encourage, and develop water transportation, service, and facilities in connection with the commerce of the United States, and to foster and preserve in full vigor both rail and water transportation.

"It shall be the duty of the Secretary of War, with the object of promoting, encouraging, and developing inland waterway transportation facilities in connection with the commerce of the United States, to investigate the appropriate types of boats suitable for different classes of such waterways; to *investigate the subject of water terminals, both for inland waterway traffic and for through traffic by water and rail, including the necessary docks, warehouses, apparatus, equipment, and appliances in connection therewith, and also railroad spurs and switches connecting with such terminals, with a view to devising the types most appropriate for different locations, and for the more expeditious and economical transfer or interchange of passengers or property between carriers by water and carriers by rail; to advise with communities, cities, and towns regarding the appropriate location of such terminals, and to co-operate with them in the preparation of plans for suitable terminal facilities; to investigate the existing status of water transportation upon the different inland waterways of the country, with a view to determining whether such waterways are being utilized to the extent of their capacity, and to what extent they are meeting the demands of traffic, and whether the water carriers utilizing such waterways are interchanging traffic with the railroads; and to investigate any other matter that may tend to promote and encourage inland water transportation. It shall also be the province and duty of the Secretary of War to compile, publish and distribute,* from time to time, such useful statistics, data, and information concerning transportation on inland waterways as he may deem to be of value to the commercial interests of the country.

"The words 'inland waterway' as used in this section shall be construed to include the Great Lakes."

APPENDIX A

Tentative Draft of Supplementary and Amendatory Treaty Between New York and New Jersey as presented for public discussion December, 1918

WHEREAS, in the year 1834 the states of New York and New Jersey did enter into a treaty fixing and determining the rights and obligations of the two states in and about the waters between the two states, especially in and about the bay of New York and the Hudson river; and

WHEREAS, since that time the commerce of the Port of New York has greatly developed and increased and the territory in and around the port has become commercially one center or district; and

WHEREAS, the future development of the terminal, transportation and other facilities of commerce in and about the port of New York can best be accomplished through the co-operation of the two states of New York and New Jersey,

NOW, THEREFORE, the said two states do supplement and amend said former treaty of 1834 as follows:

ARTICLE I. They agree to and pledge, each to the other, faithful co-operation in the future planning and development of the port of New York, holding in high trust for the benefit of the Nation the special blessings and natural advantages thereof.

ARTICLE II. To that end the two states do agree that there shall be created and they do hereby create a district to be known as the "Port of New York District" (for brevity hereinafter referred to as "The District") which shall embrace the territory bounded and described as follows: (This territory is to be determined upon after consideration.) The boundaries of said district may be changed from time to time by the action of the legislature of either state concurred in by the legislature of the other.

ARTICLE III. There is hereby created "The Port of New York Authority," which shall be a body corporate and politic, having the powers and jurisdiction hereinafter enumerated (for brevity hereinafter referred to as the "Port Authority").

ARTICLE IV. The Port Authority shall consist of six commissioners — three from the state of New York and three from the state of New Jersey, the New York members to be chosen by the state of New York and the New Jersey members to be chosen by the state of New Jersey in the manner and for the terms fixed and determined by the legislature of each state respectively; but unless and until otherwise determined they shall be designated and appointed, three from each state, by the governors thereof by and with the approval of the Senate, and, in the case of New York, at least two of the three appointees shall be residents of the City of New York. Unless and until otherwise determined by the legislature of each state, the three commissioners first appointed from each state shall hold office, respectively, one for a term of two years, one for a term of four years, and one for a term of six years; and unless otherwise provided for, all succeeding terms shall be for periods of six years. In case of vacancy occurring during a term the Governor shall fill the vacancy. Each commissioner shall hold office until his successor is duly qualified.

ARTICLE V. The Commissioners shall, for the purpose of doing business, constitute a Board and may adopt suitable by-laws for its management.

ARTICLE VI. The Port Authority shall constitute a body, both corporate and politic, with full power and authority to purchase, acquire, construct, lease and/or operate any terminal or transportation facility within said district; and to make charges and establish rates or tolls for the use thereof; and for any of such purposes to take, own, hold, lease and/or operate real or personal property, to borrow money and secure the same by bonds or by mortgages upon any property held or to be held by it; but nothing herein contained shall affect the present legal title to any property now vested in or held by either state or by any municipality, city, county, village, township or private individual or corporation, nor affect any bonded indebtedness of such state, municipality, or other body, individual or corporate.

ARTICLE VII. The Port Authority shall have such additional powers and duties as shall hereafter be delegated to it from time to time by the states of New York and/or New Jersey and/or the Federal Government. Unless and until otherwise provided, it shall make an annual report to the legislatures of both states, setting forth in detail all operations and transactions conducted by it pursuant to this treaty and any legislation thereunder.

ARTICLE VIII. No grant of land within the Port of New York District now owned by either state or in which it has any titular interest shall hereafter be made without the approval of the Port Authority.

ARTICLE IX. If the legislatures of the two states prior to the signing of this treaty or at any time thereafter adopt any plan or plans for the COMPREHENSIVE DEVELOPMENT OF THE PORT OF NEW YORK or for the whole or any part of the District, no change in such plans shall thereafter be made except by and with the approval of the Port Authority.

ARTICLE X. The Port Authority shall from time to time make plans for the further development of said district, supplementary to or amendatory of any plan theretofore adopted and when such plans are approved by the appropriate authorities within the two states, or either of them having jurisdiction thereof, they shall be binding upon both states with the same force and effect as if incorporated in this treaty.

ARTICLE XI. The Port Authority shall from time to time make recommendations to the legislatures of the two states and to the Congress of the United States, based upon study and analysis, for the better conduct of the commerce passing in and through the port of New York, the increase and improvement of transportation and terminal facilities therein and the more economical and expeditious handling of such commerce.

ARTICLE XII. The Port Authority may petition any Interstate Commerce Commission (or like body), Public Service Commission, Public Utilities Commission (or like body), or any other federal, municipal, state or local authority, administrative, judicial or legislative, having jurisdiction in the premises, for the adoption and execution of any physical improvement, change in method, rate of transportation, system of handling freight, warehousing, docking, lightering or transfer of freight, which, in the opinion of the Port Authority, may be designed to improve or better the handling of commerce in and through said district, or improve terminal and transportation facilities therein; or it may intervene in any proceeding affecting the commerce of the port; and all bodies having jurisdiction in the premises are hereby authorized and directed to consider and pass upon such application or intervention with the same force and effect as if the two states of New York and New Jersey appeared directly in support thereof.

ARTICLE XIII. The Port Authority shall elect from its number a Chairman, Vice-Chairman and may appoint a Secretary, a Chief Executive Officer, a Chief Engineer, Counsel and such clerical, engineering, legal or other staff as it may require for the performance of its duties.

ARTICLE XIV. Unless and until the revenues from operations conducted by the Port Authority are adequate to meet all expenditures, the legislatures of the two states shall appropriate, annually, for the expenses of the Port Authority, in equal amounts, such sum or sums as shall be recommended by the Port Authority and approved by the governors of the two states.

ARTICLE XV. Unless and until otherwise determined by the action of the legislatures of the two states, no action of the Port Authority shall be binding unless taken at a meeting at which at least two members from each state are present and unless four votes are cast therefor.

ARTICLE XVI. The Port Authority shall fix and determine the salaries, qualifications and duties of the Secretary, Chief Executive Officer, Chief Engineer, Counsel, Clerks, members of the legal and engineering staff and all other employes of the Port Authority.

ARTICLE XVII. Unless and until otherwise determined by the action of the legislatures of the two states, the Port Authority may make suitable orders, rules and regulations for the improvement of navigation and commerce of the District, not inconsistent with the Constitution of the United States or of either state or with Acts of Congress, which shall be binding within the District upon all persons and corporations affected thereby when the same shall be accepted by municipalities, towns, villages and other local bodies therein having a total population not less than two-thirds of the entire population of said District. The Port Authority shall give public notice of the promulgation of any such order, rule or regulation, and, unless within ninety days thereafter objection is filed by municipalities, towns, villages or other local bodies in which there is a total population not less than one-third of the entire population of the District, the said order, rule or regulation shall be deemed to be accepted and shall thereupon become valid and binding throughout the entire District. If, within one hundred days after such public notice, municipalities, towns, villages or other local bodies affected thereby in which there is a total population not less than one-third of the entire population of the District shall refuse to accept such order, rule or regulation by the vote of their duly authorized governing bodies, the Port Authority may apply, if such refusal arise within the state of New York, to the Appellate Division of the Supreme Court for the First and Second Departments (or to the successor of such court if hereafter it be changed) and/or if such refusal arise within the state of New Jersey to the Supreme Court of New Jersey (or to the successor of such court if hereafter it be changed) for a determination of the reasonableness and public necessity of such order, rule or regulation. The said courts are hereby respectively vested with jurisdiction to inquire into the facts and circumstances upon which such order, rule or regulation is based and after giving all parties interested opportunity to be heard and to present their evidence, shall make an order finding and determining whether or not such order, rule or regulation is reasonable and of public necessity. The finding of the court thereon shall be binding and conclusive upon the Port Authority and all municipalities, towns, villages or other local bodies affected thereby; and if favorable to the order, rule or regulation shall constitute acceptance thereof in lieu and in place of the refusal or failure to accept of any such municipality, town, village or other local body.

If such order, rule or regulation shall embrace only municipalities, towns, villages or other local bodies having a total population less than one-third of the entire population of the Metropolitan District, then the acceptance by such municipalities, towns, villages or other local bodies embraced within such order, rule or regulation shall be sufficient to make the same binding and effective; but if, within one hundred days after such public notice thereof, any one or more of such local bodies shall refuse or fail to act thereon, or if, by action of their duly authorized governing bodies, shall affirmatively refuse to accept such order, rule or regulation, in that event the Port Authority may apply to the court herein designated within the state wherein such refusal or failure occurs, for a determination of the reasonableness and necessity of such order, rule or regulation and the court shall have the same jurisdiction and the same power, and its order shall have the same binding force and effect upon such local body as is herein provided in this article for cases wherein the order, rule or regulation embraces the entire District.

ARTICLE XVIII. The violation of any order, rule or regulation of the Port Authority shall constitute a misdemeanor punishable with a fine of not less than Ten Dollars ($10.00) and not more than Five Thousand Dollars ($5,000.00), or by imprisonment for not more than one year, or by both fine and imprisonment; and such violations shall be prosecuted within the state within whose territory or boundary the offense occurred.

ARTICLE XIX. Nothing herein contained shall be taken to change or modify the territorial or boundary lines established by the Treaty of 1834 or the jurisdiction of the two states established thereby, except as such jurisdiction is herein delegated to or vested in the Port Authority.

APPENDIX B

Communication Addressed to Hon. John F. Hylan, Mayor, and to Hon. Robert L. Moran, President of the Board of Aldermen, from Hon. J. Henry Walters, President pro tem. of the Senate, March 11, 1919

Chapter 426 of the Laws of 1917, State of New York, and Chapter 130, 1917, Laws of the State of New Jersey, created the New York & New Jersey Port & Harbor Development Commission to study jointly and on behalf of both States the needs of the Port of New York, and to report a comprehensive physical and legal plan of its development mutually agreeable to both States. This bi-State Commission, in order to present in both States complementary legislation, conferred with Governor Smith of New York, and Governor Edge of New Jersey and the Leaders of both Houses in both States. Following such conference on the fifth day of February, 1919, a resolution was adopted in the Legislature authorizing the appointment of a special committee, consisting of the Governor, Lieutenant-Governor, Speaker of the Assembly, the Chairman of the Committee on Finance of the Senate, the Chairman of the Committee on Ways and Means of the Assembly, the Chairman of the Committees on Judiciary of the Senate and Assembly, the Majority and Minority Leaders of the Senate and Assembly, and such others as the Governor might appoint for the purpose of consulting with a similar Committee from the State of New Jersey, and the New York and New Jersey Port and Harbor Development Commission, in relation to the proposed treaty between New York and New Jersey. Pursuant to such resolution the New York Commission was created with membership as hereinbefore indicated and in addition Governor Smith named the following persons as members thereof, viz.: Hon. Charles D. Newton, Attorney-General; Hon. Murray Hulbert, Hon. William P. Burr, Corporation Counsel; Edward J. McGoldrick, Assistant Corporation Counsel, and Robert C. Cumming, Legislative Bill Drafting Commissioner. On behalf of New Jersey, Governor Edge designated as a conference committee to represent New Jersey the following persons: Hon. Thomas F. McCran, Attorney-General; Hon. Clarence E. Case, Majority Leader of the Senate; Hon. Henry E. Ackerson, Jr., Minority Leader of the Senate; Hon. Arthur W. Pierson, Speaker of the Assembly; Hon. Ralph K. Kellam, and Hon. Hugh C. Barrett, Leaders of the Assembly; and Hon. John Milton, Corporation Counsel of New Jersey.

The Legislative bi-State Commission met in New York on February fourteenth in conference with both Governors and the members of the bi-State Port Commission and their counsel. After preliminary discussion upon the subject matter of the proposed treaty a sub-committee was appointed consisting of the Attorneys-General of both States and the Majority and Minority Leaders of both Houses of both States, and the Corporation Counsel of New York City and Jersey City, for the purpose of drafting a proposed compact or treaty which might be agreeable to the representatives of both States, with instructions to report back the results of its deliberations to the general conference of the bi-State Commissions. Such bi-State sub-committee, after several sessions and after prolonged discussion and deliberation, submitted on March first, to the general conference a proposed compact or treaty for its consideration. In the submission of such proposed compact or treaty the representatives of each State reserved the right to further criticize or amend such proposal.

During the deliberations of the sub-committee as to the context of the articles of the proposed compact or treaty, Mr. Burr, Corporation Counsel of New

York, on behalf of the State of New York, suggested that the approval of the City of New York be first obtained before the treaty should become binding and effective.

The importance of the subject matter to the City of New York, its future development, its harbor development, its prestige as a leading commercial port in this country and in order that the interests of the great metropolis might be fully safeguarded in every respect, the New York State Committee requested the bi-State Commission to suspend further consideration of the report of the sub-committee until after a compact or treaty had been submitted to the officials of New York City; the members of the New York State Commission expressly reserving decision as to its final action until an examination and investigation and a report of comment, criticism, suggestion, amendment, approval or disapproval thereof was made upon the part of the City of New York.

The representatives of New Jersey acquiesced and granted the request, and accordingly the conference adjourned to await the call of the Chairman, dependent wholly upon the action and attitude of the City of New York.

As Chairman of the New York Legislative Commission, and as Leader of the Senate, I have now the honor to transmit to you copies of the proposed compact, treaty or agreement and to request you officially to advise us whether or not the proposed instrument meets with your approval and whether or not there are any criticisms, suggestions or amendments which you wish to offer in furtherance of and to safeguard the city's interest.

The comprehensive scheme proposed by the bi-State Port and Harbor Development Commission involves the waiving of very material power and authority now lodged in the City of New York over the conduct and supervision of its water fronts and appurtenances. It comprehends the delegation of regulatory powers to such Commission. On the other hand it is suggested that broad powers be granted to such Commission by the respective States so as to protect the City of New York and the Port of New York and to encourage and make attractive the investment of millions of dollars for the development of a great port beneficial to both States under a comprehensive plan which would unify and harmonize operation of a great port. Because of the objections and suggestions made on behalf of the City of New York and called to the attention of the New York State Commission, the members of the Legislature of this State are unwilling to proceed with the proceedings involving the entry into such compact or treaty, or to create such Port Authority as proposed with or without power until the City of New York, through its elected officials, has made its position in relation to the same definitely known. The responsibility of the acceptance or rejection of the proposed comprehensive scheme must now rest with the City of New York.

The New York and New Jersey Port and Harbor Development Commission will contemporaneously herewith submit to you copies of its report to the Legislature.

The New York State Commission desires to urge you to give the matter your immediate attention and serious consideration and beg you to report back with all convenient speed.

Respectfully submitted,

J. HENRY WALTERS.

APPENDIX C

Compact revised up to March 1, 1919, as follows:

WHEREAS, In the year 1834 the States of New York and New Jersey did enter into an agreement fixing and determining the rights and obligations of the two States in and about the waters between the two States, especially in and about the bay of New York and the Hudson River; and

WHEREAS, Since that time the commerce of the port of New York has greatly developed and increased and the territory in and around the port has become commercially one center or district; and

WHEREAS, It is confidently believed that a better co-ordination of the terminal, transportation and other facilities of commerce in, about and through the port of New York, will result in great economies, benefiting the Nation, as well as the two States of New York and New Jersey; and

WHEREAS, The future development of such terminal, transportation and other facilities of commerce, will require the expenditure of large sums of money, and the cordial co-operation of the States of New York and New Jersey in the encouragement of the investment of capital, and in the formulation and execution of the necessary physical plans; and

WHEREAS, Such result can best be accomplished through the co-operation of the two States by and through a joint or common agency.

NOW, THEREFORE, The said States of New Jersey and New York do supplement and amend the existing agreement of 1834 in the following respects:

ARTICLE I. They agree to and pledge, each to the other, faithful co-operation in the future planning and development of the port of New York, holding in high trust for the benefit of the Nation the special blessings and natural advantages thereof.

ARTICLE II. To that end the two States do agree that there shall be created and they do hereby create a district to be known as the "Port of New York District" (for brevity hereinafter referred to as "The District") which shall embrace the territory bounded and described as follows: (Note: This territory is to be the territory substantially as indicated in the map presented by the New York, New Jersey Port and Harbor Development Commission, accompanying this report, the description and boundary lines in such map are approved generally and are to be worked out in detail and inserted herein by the Commission.) The boundaries of said district may be changed from time to time by the action of the Legislature of either State concurred in by the Legislature of the other.

ARTICLE III. There is hereby created "The Port of New York Authority" (for brevity hereinafter referred to as the "Port Authority"), which shall be a body corporate and politic, having the powers and jurisdiction hereinafter enumerated, and such other and additional powers as shall be conferred upon it by the Legislature of either State concurred in by the Legislature of the other or by Act or Acts of Congress, as hereinafter provided.

ARTICLE IV. The Port Authority shall consist of six commissioners — three resident voters from the State of New York, two of whom shall be resident voters of the City of New York, and three resident voters from the State of New Jersey, two of whom shall be resident voters within the New Jersey portion of the district, the New York members to be chosen by the State of New York and the New Jersey members by the State of New Jersey, in the manner and for the terms fixed and determined by the Legislature of each State respectively.

Each commissioner may be removed from office as provided by the law of the State for which he shall be appointed.

ARTICLE V. The Commissioners shall, for the purpose of doing business, constitute a board and may adopt suitable by-laws for its management.

ARTICLE VI. The Port Authority shall constitute a body, both corporate and politic, with full power and authority to purchase, construct, lease and/or operate any terminal or transportation facility within said district; and to make charges for the use thereof; and for any of such purposes to own, hold, lease and/or operate real or personal property, to borrow money and secure the same by bonds or by mortgages upon any property held or to be held by it. No property now or hereafter vested in or held by either State, or by any county, city, borough, village, township or other municipality shall be taken by the Port Authority, without the authority or consent of such State, county, city, borough, village, township or other municipality, nor shall anything herein impair or invalidate in any way any bonded indebtedness of such State, county, city, borough, village, township or other municipality, nor impair the provisions of law regulating the payment into sinking funds of revenues derived from municipal property, or dedicating the revenues derived from any municipal property to a specific purpose.

The powers granted in this article shall not be exercised by the Port Authority until the Legislatures of both States shall have approved of a comprehensive plan for the development of the port as hereinafter provided; provided, however, that the Legislature of either State with the approval of the Legislature of the other State may from time to time authorize the Port Authority to proceed with specific matters.

ARTICLE VII. The Port Authority shall have such additional powers and duties as shall hereafter be delegated to or imposed upon it from time to time by the action of the Legislature of either State concurred in by the other. Unless and until otherwise provided, it shall make an annual report to the Legislature of both States setting forth in detail the operations and transactions conducted by it pursuant to this agreement and any legislation thereunder. The Port Authority shall not pledge the credit of either State except by and with the authority of the Legislature thereof.

ARTICLE VIII. Unless and until otherwise provided, all laws now or hereafter vesting jurisdiction or control in the Public Service Commission, or the Public Utilities Commission, or like body, within each State respectively, shall apply to railroads and to any transportation, terminal or other facility owned, leased, operated or constructed by the Port Authority, with the same force and effect as if such railroad, or other transportation, terminal or other facility were owned, leased, operated or constructed by a private corporation.

ARTICLE IX. The Legislatures of the two States, prior to the signing of this agreement, or thereafter as soon as may be practicable, will adopt a plan or plans for the comprehensive development of the port of New York. Thereafter, no change in such plans shall be made except by and with the approval of the Legislature of both States.

ARTICLE X. The Port Authority shall from time to time make plans for the further development of said district, supplementary to or amendatory of any plan theretofore adopted and when such plans are duly approved by the Legislatures of the two States, they shall be binding upon both States with the same force and effect as if incorporated in this agreement.

ARTICLE XI. The Port Authority may from time to time make recommendations to the Legislatures of the two States or to the Congress of the United States, based upon study and analysis, for the better conduct of the commerce passing in and through the port of New York, the increase and improvement of transportation and terminal facilities therein and the more economical and expeditious handling of such commerce.

ARTICLE XII. The Port Authority may petition any Interstate Commerce Commission (or like body), Public Service Commission, Public Utilities Commission (or like body), or any other federal, municipal, State or local authority, administrative, judicial or legislative, having jurisdiction in the premises, after the adoption of the comprehensive plan as provided for in Article IX for the adoption and execution of any physical improvement, change in method, rate of transportation, system of handling freight, warehousing, docking, lightering or transfer of freight, which, in the opinion of the Port Authority, may be designed to improve or better the handling of commerce in and through said district, or improve terminal and transportation facilities therein. It may intervene in any proceeding affecting the commerce of the port.

ARTICLE XIII. The Port Authority shall elect from its number a Chairman, Vice Chairman and may appoint such officers and employees as it may require for the performance of its duties and shall fix and determine their qualifications and duties.

ARTICLE XIV. Unless and until the revenues from operations conducted by the Port Authority are adequate to meet all expenditures, the Legislatures of the two States shall appropriate, annually, for the salaries, office and other administrative expenses, in equal amounts, such sum or sums as shall be recommended by the Port Authority and approved by the Governors of the two States, not exceeding for each State the sum of $100,000.

ARTICLE XV. Unless and until otherwise determined by the action of the Legislatures of the two States, no action of the Port Authority shall be binding unless taken at a meeting at which at least two members from each State are present and unless four votes are cast therefor, two from each State. [Each State reserves the right hereafter to provide by law for the exercise of a veto power by the Governor thereof over any action of the Port Authority.]

ARTICLE XVI. Unless and until otherwise determined by the action of the Legislatures of the two States, the Port Authority shall not incur any obligations for salaries, office or other administrative expenses, within the provisions of Article XIV prior to the making of appropriations adequate to meet the same.

ARTICLE XVII. The Port Authority is hereby authorized to make suitable rules and regulations not inconsistent with the Constitution of the United States or of either State, and subject to the exercise of the power of Congress for the improvement of the conduct of navigation and commerce, which when concurred in by the Legislatures of both States, shall be binding and effective upon all persons and corporations affected thereby.

ARTICLE XVIII. The two States shall provide penalties for violations of any order, rule or regulation of the Port Authority, and for the manner of enforcing the same.

ARTICLE XIX. The territorial or boundary lines established by the agreement of 1834, or the jurisdiction of the two States established thereby shall not be changed except as herein specifically modified.

ARTICLE XX. Definitions.— The following words as herein used shall have the following meaning: "*Transportation facility*" shall include railroads, steam or electric, motor truck or other street or highway vehicles, tunnels, bridges, boats, ferries, car-floats, lighters, tugs, floating elevators, barges, scows or harbor craft of any kind, air craft suitable for harbor service, and every kind of transportation facility now in use or hereafter designed for use for the transportation or carriage of persons or property. "*Terminal facility*" shall include wharfs, piers, slips, ferries, docks, dry docks, bulkheads, dock-walls, basins, car-floats, float-bridges, grain or other storage elevators, warehouses, cold storage, tracks, yards, sheds, switches, connections, overhead appliances, and every kind of terminal or storage facility now in use or hereafter designed for use for the handling, storage, loading or unloading of freight at steamship, railroad or freight terminals. "*Railroads*" shall include railways, extensions thereof, tunnels, subways, bridges, elevated structures, tracks, poles, wires, conduits, power houses, substations, lines for the transmission of power, car-barns, shops, yards, sidings, turn-outs, switches, stations and approaches thereto, cars and motive equipment. "*Facility*" shall include all works, buildings, structures, appliances and appurtenances necessary and convenient for the proper construction, equipment, maintenance and operation of such facility or facilities or any one or more of them. "*Real Property*" shall include land under water, as well as uplands, and all property either now commonly or legally defined as real property or which may hereafter be so defined. "*Personal Property*" shall include choses in action and all other property now commonly or legally defined as personal property or which may hereafter be so defined. "*To lease*" shall include to rent or to hire. "*Rule or regulation*," until and unless otherwise determined by the Legislatures of both States, shall mean any rule or regulation not inconsistent with the Constitution of the United States or of either State, and, subject to the exercise of the power of Congress, for the improvement of the conduct of navigation and commerce within the district, and shall include charges, rates, rentals or tolls fixed or established by the Port Authority; and until otherwise determined as aforesaid, shall not include matters relating to harbor or river pollution. Wherever action by the Legislature of either State is herein referred to, it shall mean an act of the Legislature duly adopted in accordance with the provisions of the Constitution of the State.

APPENDIX D

Resolution Adopted by the Board of Estimate and Apportionment on April 4, 1919

Resolved, That while the Board of Estimate and Apportionment is impressed with the necessity for co-operation between the two States of New York and New Jersey to develop the Port of New York, and to that end is ready to immediately consider and carefully study any comprehensive plan having that for its object, the Board is fully convinced that the presentation and adoption of such comprehensive plan should precede the making of the Proposed Treaty granting such vast powers for all time to the Port Authority in the Port District to be created thereby, and recommends that the present existing New York-New Jersey Port and Harbor Development Commission appointed under Chapter 426, Laws of 1917, State of New York, and Chapter 130, Laws of 1917, State of New Jersey, be continued in existence so as to permit the said Commission, as a result of the studies it has already made and is still making, to present such comprehensive physical plan for examination and study, together with a comprehensive statement of the ways and means to carry such plan into effect.

The said New York-New Jersey Port and Harbor Development Commission was appointed

> "to negotiate or agree upon a joint report, recommending a policy to be pursued by the State of New York, the State of New Jersey and the United States by legislative enactment or treaty or otherwise, to the end that the said port shall be efficiently and constructively organized and furnished with modern methods of piers, rail and water and freight facilities and adequately protected in the event of war. Before making such

> report, such commission shall make a thorough investigation of port conditions in this country and shall take and employ such engineering, legal or other professional skill and assistance as it may need for the effective working out of a comprehensive and adequate interstate and federal port policy, to meet commercial needs in times of peace and the protection of the harbor and adjacent localities in times of war."

The Board of Estimate and Apportionment will give its most earnest thought and consideration to devising methods by which such comprehensive plan, if approved, may be successfully carried into operation, either through the Proposed Treaty or such other legal procedure as may be deemed necessary or advisable. As matter of fact, the Treaty proposed defers the exercise of any real power by the Port Authority until the adoption of the comprehensive plan (Article VI). Therefore, no harmful delay can result from the change in procedure now recommended by this Board.

The City of New York has for many years been engaged in the development of the Port through its Dock Department and Sinking Fund Commission, and has made great progress since 1871 in carrying out such port and harbor development and improvements.

In the New York Harbor case, recently decided by the Interstate Commerce Commission, December 17, 1917, Commissioner Harlan said:

LACK OF CENTRAL ADMINISTRATIVE CONTROL IN NEW JERSEY

"The inactivity of the municipalities and of the State authorities in New Jersey with respect to the improvement and development of the west side of the harbor is noticeable. The contrast between the notable progress of the city of New York, on the one hand, and the inaction of New Jersey on the other is striking.

"This difference in policy is attributable primarily to a difference in conditions. For more than 40 years, as previously explained, New York's whole harbor policy has been in the hands of a single department, which now has jurisdiction not only in Manhattan but in the Bronx, in Brooklyn, and in Staten Island, all of which are a part of the greater city. The results of this concentration of authority in a single body have been most beneficial. The whole port, or such part of it as lies in the State of New York, can be developed as a unit, with due regard to the advantage and disadvantage of each part. If all the large steamers can not be accommodated on the west side of Manhattan they may be accommodated in South Brooklyn; if a railroad applicant for pier space on the east side of Manhattan can not be accommodated there, it may be conveniently located in Wallabout Bay; if the ferry service between Manhattan Island and Staten Island is unsatisfactory, the city of New York constructs and operates municipal ferryboats to afford the desired service; and if the ferries operating across the East River are not adequate to carry the rapidly increasing number of passengers traveling between Manhattan Island and Long Island, tunnels are constructed under the river and subway trains operated through them. The advantages which the city derives from the concentration of port authority in a single administrative body are numerous and obvious.

"In New Jersey the opposite conditions prevail. In that portion of the State which is commonly regarded as being within 'the metropolitan district,' embracing all or parts of the counties of Hudson, Bergen, Passaic, Essex, Union and Middlesex, there are scores of cities, towns and villages, each of which has separate control of its own municipal affairs. Opposite Manhattan Island, on the west side of the Hudson River, are the towns of Edgewater, Guttenburg and Weehawken and the cities of Hoboken and Jersey City, and farther to the south is the city of Bayonne. Each of these municipalities has a separate corporate existence, and each has the power, independently of the others, to take such action as it pleases with reference to the development of its own water front, or to take no action at all.

"In 1910, the then Governor of New Jersey appointed a commission of three members to study the problem of port development, and especially to find some method of accommodating large vessels in the harbor without extending the piers farther into the river. That commission worked in co-operation with a similar body representing the State of New York. In 1911, following the report of the New Jersey Commission to the Legislature of that State, the New Jersey Harbor Commission was created, consisting of five members. In 1915 this commission was merged, together with several others, into the New Jersey Board of Commerce and Navigation. Investigations conducted by this board led it to the conclusion that the present adjustment of freight rates results in injustice to New Jersey, and it therefore recommended to the Governor of that State that he appoint a special committee to discover ways and means of procuring a more equitable rate adjustment. That Committee, which is known as 'the Committee on Ways and Means to Prosecute the Case of Alleged Rate and Service Discrimination at the Port of New York,' was duly appointed, and it has joined with the New Jersey Board of Commerce and Navigation, with the cities of Newark, Hoboken, Jersey City and Elizabeth, in instituting the present proceeding.

"There is no department or board in New Jersey, either state or municipal, whose powers are analogous to those possessed by the Dock Department of the City of New York. The New Jersey Board of Commerce and Navigation has power to lease or sell riparian lands belonging to the State; to inspect power vessels on inbound waterways; to aid in the movement for the construction of a ship canal across the State; to aid the municipalities in developing their water fronts; and generally to supervise the development of port facilities. The board has no power to construct docks or bulkheads, to dig channels, or to provide the funds which are needed for the proper development of the harbor. It can accomplish those things, if at all, only indirectly, by using its influence with the several municipalities and urging them to co-operate. Even the Legislature of the State of New Jersey is forbidden, by a constitutional provision, to incur a debt of more than $100,000 without the consent of the people of the State.

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"The result of the division of authority in New Jersey and of the lack of foresight on the part of individual municipalities is strikingly evidenced at Jersey City. Located almost in the heart of one of the best harbors in the world, with more than 5 miles of frontage on the lower Hudson River and upper New York Bay, and served by five of the country's great trunk lines of railroad; in short, possessing all the qualifications which a seaport of the first rank should have Jersey City has been content to see her valuable water front 'turned into a huge railroad yard.' Of her 5 miles of shore line more than 90 per cent. is owned by the carriers. Of the 133 long piers on the New Jersey side of the harbor only one is publicly owned. An engineer employed by the municipal authorities of Jersey City in 1915 to study the general conditions of the water front and to report on the opportunities for developing it, discovered that of the total harbor frontage of 26,454 feet the city owned but 125 feet; and he could only report that Jersey City, 'intended by nature to be a great seaport' had 'failed lamentably in the realization of this manifest destiny' and that she had 'entirely neglected to take advantage of these natural and artificial opportunities for greatness in maritime affairs.'

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"Since the very earliest days of transportation through the Erie Canal it has been customary to apply the same rates by boat from Manhattan and Brooklyn as from Jersey City and Hoboken, and the same policy will be followed when the new barge canal is completed."

This Board invites and will welcome the active and earnest co-operation of New Jersey in any movement tending to improve and develop the Port of New York in all its parts and to the fullest extent, including matters relating to river and harbor pollution, which now constitutes a grave menace to the harbor of New York, and the abatement of the nuisance arising from the poisonous fumes generated in the factories or plants situated on the New Jersey shore opposite Riverside Drive, which nuisance is most injurious to the health and detrimental to the property of the people residing in that locality.

APPENDIX E

Resolution Adopted by the Legislature of the State of New Jersey Continuing the Legislative Commission to Aid in the Drafting of the Treaty

Joint Resolution creating a commission consisting of persons to be appointed by the Governor, which commission shall meet and confer with such commission as may be appointed by the Legislature of the State of New York, and with the New York-New Jersey Port and Harbor Development Commission for the purpose of completing a draft of a compact between the States of New Jersey and New York for the development of the port of New York and the establishment of a central port authority.

Whereas, Various conferences have been held by representatives of the Legislature of the States of New Jersey and New York with the New York-New Jersey Port and Harbor Development Commission for the purpose of drafting a proposed compact between the States of New Jersey and New York for the development of the port of New York and the creation of a central port authority; and

Whereas, At a meeting held in the city of New York on the fifth day of April, one thousand nine hundred and nineteen, it was decided to postpone the submission of such compact to the said States until the next session of the Legislatures thereof, and that conferences be continued for the purpose of completing a compact to be submitted for ratification; therefore,

Be it resolved *by the Senate and General Assembly of the State of New Jersey:*

1. There is hereby created a commission consisting of eight persons to be appointed by the Governor, which commission shall meet and confer with such commission as may be appointed by the Legislature of the State of New York and with the New York-New Jersey Port and Harbor Development Commission for the purpose of completing a draft of a compact between the States of New Jersey and New York for the development of the port of New York and the creation of a central port authority, such compact to be submitted to the Legislatures of the said States of New Jersey and New York at the next session thereof.
2. This resolution shall take effect immediately.

Approved April 14, 1919.

APPENDIX F

Proposed Statute (1920) Authorizing Compact (as Introduced Both in New York and New Jersey and as Passed by New Jersey Legislature at 1920 Session)

AN ACT authorizing designated authorities in behalf of the state of New York to enter into an agreement or compact with designated authorities of the state of New Jersey for the creation of the "Port of New York District," the establishment of "The Port of New York Authority," and the defining of the powers and duties of such authority.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. William R. Willcox, Eugenius H. Outerbridge and Murray Hulbert, or any two of them, commissioners heretofore appointed under chapter four hundred and twenty-six of the laws of nineteen hundred and seventeen of the state of New York, together with the attorney-general of the state of New York, are hereby authorized as commissioners upon the part of the state of New York to enter into, with the state of New Jersey, by and through the commissioners appointed or who may be appointed under or by virtue of a law of the legislature of the state of New Jersey, an agreement or compact in the form following, that is to say:

Whereas, In the year eighteen hundred and thirty-four the states of New York and New Jersey did enter into an agreement fixing and determining the rights and obligations of the two states in and about the waters between the two states, especially in and about the bay of New York and the Hudson river; and

Whereas, Since that time the commerce of the port of New York has greatly developed and increased and the territory in and around the port has become commercially one center or district; and

Whereas, It is confidently believed that a better co-ordination of the terminal, transportation and other facilities of commerce in, about and through the port of New York, will result in great economies, benefiting the nation, as well as the states of New York and New Jersey; and

Whereas, The future development of such terminal, transportation and other facilities of commerce will require the expenditure of large sums of money and the cordial co-operation of the states of New York and New Jersey in the encouragement of the investment of capital, and in the formulation and execution of the necessary physical plans; and

Whereas, Such result can best be accomplished through the co-operation of the two states by and through a joint or common agency.

Now, therefore, The said states of New Jersey and New York do supplement and amend the existing agreement of eighteen hundred and thirty-four in the following respects:

ARTICLE I.

They agree to and pledge, each to the other, faithful co-operation in the future planning and development of the port of New York, holding in high trust for the benefit of the nation the special blessings and natural advantages thereof.

ARTICLE II.

To that end the two states do agree that there shall be created and they do hereby create a district to be known as the "Port of New York District" (for brevity hereinafter referred to as "The District") which shall embrace the territory bounded and described as follows:

The district is included within the boundary lines located by connecting points of known latitude and longitude. The approximate courses and distances of the lines enclosing the district are recited in the description, but the district is determined by drawing lines through the points of known latitude and longitude. Beginning at a point A of latitude forty-one degrees and four minutes north and longitude seventy-three degrees and fifty-six minutes west, said point being about sixty-five hundredths of a mile west of the westerly bank of the Hudson river and about two and one-tenth miles northwest of the pier at Piermont, in the county of Rockland, state of New York; thence due south one and fifteen-hundredths miles more or less to a point B of latitude forty-one degrees and three minutes north and longitude seventy-three degrees and fifty-six minutes west; said point being about one and three-tenths miles northwest of the pier at Piermont, in the county of Rockland, state of New York; thence south fifty-six degrees four minutes west six and twenty-six-hundredths miles more or less to a point C of latitude forty-one degrees and no minutes north and longitude seventy-four degrees and two minutes west, said point being about seven-tenths of a mile north of the railroad station at Westwood, in the county of Bergen, state of New Jersey; thence south sixty-eight degrees and twenty-four minutes west nine and thirty-seven-hundredths miles more or less to a point D of latitude forty degrees and fifty-seven minutes north and longitude seventy-four degrees and twelve minutes west, said point about three miles northwest of the business center of the city of Paterson, in the county of Passaic, state of New Jersey; thence south forty-seven degrees and seventeen minutes west eleven and eighty-seven-hundredths miles more or less to a point E of latitude forty degrees and fifty minutes north and longitude seventy-four degrees and twenty-two minutes west, said point being about four and five-tenths miles west of the borough of Caldwell, in the county of Morris, state of New Jersey; thence due south nine and twenty-hundredths miles more or less to a point F of latitude forty degrees and forty-two minutes north and longitude seventy-four degrees and twenty-two minutes west, said point being about one and two-tenths miles southwest of the passenger station of the Delaware, Lackawanna and Western railroad in the city of Summit, in the county of Essex,* state of New Jersey; thence south forty-two degrees and twenty-four minutes west, seven and seventy-eight-hundredths miles more or less to a point G of latitude forty degrees and thirty-seven minutes north and longitude seventy-four degrees and twenty-eight minutes west, said point being about two and two-tenths miles west of the business center of the city of Plainfield, in the county of Somerset, state of New Jersey; thence due south twelve and sixty-five-hundredths miles more or less on a line passing about one mile west of the business center of the city of New Brunswick to a point H of latitude forty degrees and twenty-six minutes north and longitude seventy-four degrees and twenty-eight minutes west, said point being about four and five-tenths miles southwest of the city of New Brunswick, in the county of Middlesex, state of New Jersey; thence south seventy-seven degrees and forty-two minutes east ten and seventy-nine-hundredths miles more or less to a point I of latitude forty degrees and twenty-four minutes north and longitude seventy-four degrees and sixteen minutes west, said point being about two miles southwest of the borough of Matawan, in the county of Middlesex, state of New Jersey; thence due east twenty-five and forty-eight-hundredths miles more or less, crossing the county of Monmouth, state of New Jersey, and passing about one and four-tenths miles south of the pier of the Central Railroad of New Jersey at Atlantic Highlands to a point J of latitude forty degrees and twenty-four minutes north and longitude seventy-three degrees and forty-seven minutes west, said point being in the Atlantic ocean; thence north eleven degrees fifty-eight minutes east twenty-one and sixteen-hundredths miles more or less to a point K, said point being about five miles east of the passenger station of the Long Island railroad at Jamaica and about one and three-tenths miles east of the boundary line of the city of New York, in the county of Nassau, state of New York; thence in a northeasterly direction passing about one-half mile west of New Hyde Park and about one and one-tenth miles east of the shore of Manhasset bay at Port Washington, crossing Long Island sound to a point L, said point being the point of intersection of the boundary line between the states of New York and Connecticut and the meridian of seventy-three degrees, thirty-nine minutes and thirty seconds west longitude, said point being also about a mile northeast of the village of Port Chester; thence northwesterly along the boundary line between the states of New York and Connecticut to a point M, said point being the point of intersection between said boundary line between the states of New York and Connecticut and the parallel of forty-one degrees and four minutes north latitude, said point also being about four and five-tenths miles northeast of the business center of the city of White Plains; thence due west along said parallel, of forty-one degrees and four minutes north latitude, the line passing about two and one-half miles north of the business center of the city of White Plains and crossing the Hudson river to the point A, the place of beginning.

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* Error, Should be "Union," not "Essex."

The boundaries of said district may be changed from time to time by the action of the legislature of either state concurred in by the legislature of the other.

ARTICLE III.

There is hereby created "The Port of New York Authority" (for brevity hereinafter referred to as the "Port Authority"), which shall be a body corporate and politic, having the powers and jurisdiction hereinafter enumerated, and such other and additional powers as shall be conferred upon it by the legislature of either state concurred in by the legislature of the other, or by act or acts of congress, as hereinafter provided.

ARTICLE IV.

The port authority shall consist of six commissioners — three resident voters from the state of New York, two of whom shall be resident voters of the city of New York and recommended by the municipality of the city of New York, and three resident voters from the state of New Jersey, two of whom shall be resident voters within the New Jersey portion of the district, the New York members to be chosen by the state of New York and the New Jersey members by the state of New Jersey, in the manner and for the terms fixed and determined from time to time by the legislature of each state respectively, except as herein provided.

Each commissioner may be removed or suspended from office as provided by the law of the state for which he shall be appointed.

ARTICLE V.

The commissioners shall, for the purpose of doing business, constitute a board and may adopt suitable by-laws for its management.

ARTICLE VI.

The port authority shall constitute a body, both corporate and politic, with full power and authority to purchase, construct, lease and/or operate any terminal or transportation facility within said district; and to make charges for the use thereof; and for any of such purposes to own, hold, lease and or operate real or personal property, to borrow money and secure the same by bonds or by mortgages upon any property held or to be held by it. No property now or hereafter vested in or held by either state, or by any county, city, borough, village, township or other municipality, shall be taken by the port authority, without the authority or consent of such state, county, city, borough, village, township or other municipality, nor shall anything herein impair or invalidate in any way any bonded indebtedness of such state, county, city, borough, village, township or other municipality, nor impair the provisions of law regulating the payment into sinking funds of revenues derived from municipal property, or dedicating the revenues derived from any municipal property to a specific purpose.

The powers granted in this article shall not be exercised by the port authority until the legislatures of both states shall have approved of a comprehensive plan for the development of the port as hereinafter provided.

ARTICLE VII.

The port authority shall have such additional powers and duties as may hereafter be delegated to or imposed upon it from time to time by the action of the legislature of either state concurred in by the legislature of the other. Unless and until otherwise provided, it shall make an annual report to the legislature of both states, setting forth in detail the operations and transactions conducted by it pursuant to this agreement and any legislation thereunder. The port authority shall not pledge the credit of either state except by and with the authority of the legislature thereof.

ARTICLE VIII.

Unless and until otherwise provided, all laws now or hereafter vesting jurisdiction or control in the public service commission, or the public utilities commission, or like body, within each state respectively, shall apply to railroads and to any transportation, terminal or other facility owned, operated, leased or constructed by the port authority, with the same force and effect as if such railroad, or transportation, terminal or other facility were owned, leased, operated or constructed by a private corporation.

ARTICLE IX.

Nothing contained in this agreement shall impair the powers of any municipality to develop or improve port and terminal facilities.

ARTICLE X.

The legislatures of the two states, prior to the signing of this agreement, or thereafter as soon as may be practicable, will adopt a plan or plans for the comprehensive development of the port of New York. No city within the port district shall be bound by the comprehensive plan unless and until it has approved of the same. After the adoption of the plan or plans by the legislatures of both states, no modification in such plan or plans shall be made except by the port authority with the approval of the municipality or municipalities directly affected by such modifications.

ARTICLE XI.

The port authority shall from time to time make plans for the development of said district, supplementary to or amendatory of any plan theretofore adopted, and when such plans are duly approved by the legislatures of the two states, they shall be binding upon both states with the same force and effect as if incorporated in this agreement.

ARTICLE XII.

The port authority may from time to time make recommendations to the legislatures of the two states or to the congress of the United States, based upon study and analysis, for the better conduct of the commerce passing in and through the port of New York, the increase and improvement of transportation and terminal facilities therein, and the more economical and expeditious handling of such commerce.

ARTICLE XIII.

The port authority may petition any interstate commerce commission (or like body), public service commission, public utilities commission (or like body), or any other federal, municipal, state or local authority, administrative, judicial or legislative, having jurisdiction in the premises, after the adoption of the comprehensive plan as provided for in article X for the adoption and execution of any physical improvement, change in method, rate of transportation, system of handling freight, warehousing, docking, lightering or transfer of freight, which, in the opinion of the port authority, may be designed to improve or better the handling of commerce in and through said district, or improve terminal and transportation facilities therein. It may intervene in any proceeding affecting the commerce of the port.

ARTICLE XIV.

The port authority shall elect from its number a chairman, vice-chairman, and may appoint such officers and employees as it may require for the performance of its duties, and shall fix and determine their qualifications and duties.

ARTICLE XV.

Unless and until the revenues from operations conducted by the port authority are adequate to meet all expenditures, the legislatures of the two states shall appropriate, in equal amounts, annually, for the salaries, office and other administrative expenses, such sum or sums as shall be recommended by the port authority and approved by the governors of the two states, but each state obligates itself hereunder only to the extent of one hundred thousand dollars in any one year.

ARTICLE XVI.

Unless and until otherwise determined by the action of the legislatures of the two states, no action of the port authority shall be binding unless taken at a meeting at which at least two members from each state are present and unless four votes are cast therefor, two from each state. Each state reserves the right hereafter to provide by law for the exercise of a veto power by the governor thereof over any action of any commissioner appointed therefrom.

ARTICLE XVII.

Unless and until otherwise determined by the action of the legislatures of the two states, the port authority shall not incur any obligations for salaries, office or other administrative expenses, within the provisions of article XV, prior to the making of appropriations adequate to meet the same.

ARTICLE XVIII.

The port authority is hereby authorized to make suitable rules and regulations not inconsistent with the constitution of the United States or of either state, and subject to the exercise of the power of congress, for the improvement of the conduct of navigation and commerce, which, when concurred in or authorized by the legislatures of both states, shall be binding and effective upon all persons and corporations affected thereby.

ARTICLE XIX.

The two states shall provide penalties for violations of any order, rule or regulation of the port authority, and for the manner of enforcing the same.

ARTICLE XX.

The territorial or boundary lines established by the agreement of eighteen hundred and thirty-four, or the jurisdiction of the two states established thereby, shall not be changed except as herein specifically modified.

ARTICLE XXI.

Either state may by its legislature withdraw from this agreement in the event that a plan for the comprehensive development of the port shall not have been adopted by both states on or prior to July first, nineteen hundred and twenty-one; and when such withdrawal shall have been communicated to the governor of the other state by the state so withdrawing, this agreement shall be thereby abrogated.

ARTICLE XXII.

Definitions. The following words as herein used shall have the following meaning: "Transportation facility" shall include railroads, steam or electric, motor truck or other street or highway vehicles, tunnels, bridges, boats, ferries, car-floats, lighters, tugs, floating elevators, barges, scows or harbor craft of any kind, air craft suitable for harbor service, and every kind of transportation facility now in use or hereafter designed for use for the transportation or carriage of persons or property. "Terminal facility" shall include wharves, piers, slips, ferries, docks, dry docks, bulkheads, dock-walls, basins, car-floats, float-bridges, grain or storage elevators, warehouses, cold storage, tracks, yards, sheds, switches, connections, overhead appliances, and every kind of terminal or storage facility now in use or hereafter designed for use for the handling, storage, loading or unloading of freight at steamship, railroad or freight terminals. "Railroads" shall include railways, extensions thereof, tunnels, subways, bridges, elevated structures, tracks, poles, wires, conduits, power houses, substations, lines for the transmission of power, car-barns, shops, yards, sidings, turn-outs, switches, stations and approaches thereto, cars and motive equipment. "Facility" shall include all works, buildings, structures, appliances and appurtenances necessary and convenient for the proper construction, equipment, maintenance and operation of such facility or facilities or any one or more of them. "Real property" shall include land under water, as well as uplands, and all property either now commonly or legally defined as real property or which may hereafter be so defined. "Personal property" shall include choses in action and all other property now commonly or legally defined as personal property or which may hereafter be so defined. "To lease" shall include to rent or to hire. "Rule or regulation," until and unless otherwise determined by the legislatures of both states, shall mean any rule or regulation not inconsistent with the constitution of the United States or of either state, and, subject to the exercise of the power of congress, for the improvement of the conduct of navigation and commerce within the district, and shall include charges, rates, rentals or tolls fixed or established by the port authority; and until otherwise determined as aforesaid, shall not include matters relating to harbor or river pollution. Wherever action by the legislature of either state is herein referred to, it shall mean an act of the legislature duly adopted in accordance with the provisions of the constitution of the state.

Plural or singular. The singular wherever used herein shall include the plural.

Consent, approval or recommendation of municipality; how given. Wherever herein the consent, approval or recommendation of a "municipality" is required, the word "municipality" shall be taken to include any city or incorporated village within the port district, and in addition in the state of New Jersey any borough, town, township or any municipality governed by an improvement commission within the district. Such consent, approval or recommendation whenever required in the case of the city of New York shall be deemed to have been given or made whenever the board of estimate and apportionment of said city or any body hereafter succeeding to its duties shall by majority vote pass a resolution expressing such consent, approval or recommendation; and in the case of any municipality now or hereafter governed by a commission, whenever the commission thereof shall by majority vote pass such a resolution; and in all other cases whenever the body authorized to grant consent to the use of the streets or highways of such municipality shall by a majority vote pass such a resolution. The legislature of the state of New York shall provide for the manner of appointment of commissioners to the port authority in the event of the failure of the municipality of the city of New York to make recommendations in accordance with article four hereof.

§ 2. The said agreement or compact, when signed and sealed by the commissioners of each state as hereinbefore provided, and the attorney-general of the state of New York, and the attorney-general of the state of New Jersey if he be designated so to act by the state of New Jersey, shall become binding upon the state of New York, and shall be filed in the office of the secretary of state of the state of New York.

§ 3. If by death, resignation or otherwise, a vacancy occurs among those appointed hereunder by the state of New York, the governor is hereby authorized to fill the same.

§ 4. The said commissioners, together with the commissioners appointed from the state of New Jersey, shall have power to apply to the congress of the United States for its consent and approval of the agreement or compact signed by them; but in the absence of such consent of congress and until the same shall have been secured, the said agreement or compact shall be binding upon the state of New York in all respects permitted by law for the two states of New York and New Jersey without the consent of congress to co-operate, for the purposes enumerated in said agreement or compact, and in the manner provided therein.

APPENDIX G

Allen Port Treaty Bill Introduced in Legislature of New Jersey and Passed by Senate March 30, 1920, and by Assembly April 15, 1920

AN ACT to authorize a commission to enter into a compact or agreement with the State of New York for the development of the port of New York.

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey:*

1. J. Spencer Smith, De Witt Van Buskirk and Frank R. Ford, or any two of them, commissioners heretofore appointed under chapter 130 of the Laws of 1917, of the State of New Jersey, together with the Attorney-General of the State of New Jersey, are hereby authorized as commissioners upon the part of the State of New Jersey to enter into, with the State of New York, by and through the commissioners appointed or who may be appointed under or by virtue of a law of the Legislature of the State of New York, an agreement or compact in the form following, that is to say:

[Here follows Treaty as in Appendix F.]

2. The said agreement or compact, when signed and sealed by the commissioners of each State as hereinbefore provided, and the Attorney-General of the State of New Jersey, and the Attorney-General of the State of New York, if he be designated so to act by the State of New York, shall become binding upon the State of New Jersey, and shall be filed in the office of the Secretary of State of the State of New Jersey.

3. If by death, resignation or otherwise, a vacancy occurs among those appointed hereunder by the State of New Jersey, the Governor is hereby authorized to fill the same.

4. The said commissioners, together with the commissioners appointed from the State of New York, shall have power to apply to the Congress of the United States for its consent and approval of the agreement or compact signed by them; but in the absence of such consent of Congress and until the same shall have been secured, the said agreement or compact shall be binding upon the State of New Jersey in all respects permitted by law for the two States of New York and New Jersey without the consent of Congress to co-operate, for the purposes enumerated in said agreement or compact, and in the manner provided therein.

APPENDIX H

Brief Submitted to the Board of Estimate and Apportionment of New York City by the Commission, January 23, 1920

In the Matter of the Proposed Compact between the States of NEW YORK and NEW JERSEY, Now Under Preparation by the NEW YORK, NEW JERSEY PORT AND HARBOR DEVELOPMENT COMMISSION, in Co-operation with the LEGISLATIVE BI-STATE COMMISSION, Consisting of the President of the Senate, the Minority Leader, the Speaker of the Assembly, the Majority Leader of the Assembly, the Minority Leader of the Assembly, the Attorney-General of Each State, Together with the Chairmen of Other Committees, the Corporation Counsel of the City of New York and of Jersey City.

Memorandum presented by the New York, New Jersey Port and Harbor Development Commission to the Board of Estimate and Apportionment, January 23rd, 1920, in response to its request for a statement of the reasons for reconsideration of the resolution adopted by the Board of Estimate and Apportionment on April 4th, 1919, together with a statement of the reasons for the approval of the proposed compact between the two States.

The Present Status of the Compact

As a result of a conference held January 29, 1919, between the members of the New York, New Jersey Port and Harbor Development Commission, their counsel, and Governor Alfred E. Smith of New York and Governor Walter E. Edge of New Jersey, it was agreed that a Legislative Bi-State Commission should be appointed, which should co-operate with the Port Commission in the consideration and revision of the compact, so that it might be presented in complementary form to the Legislatures of both States. Pursuant to this determination such a Legislative Bi-State Commission was appointed, and after conferring with the Port Commission and its counsel, revised the proposed draft of the compact. On March 1st Governor Smith, Speaker Sweet and Senator Walters requested further adjournment of the conference until the administrative officials of the City of New York might be given opportunity to consider the proposed compact and express their views thereon. Pursuant thereto Hon. J. Henry Walters, president *pro tem.* of the Senate, addressed a communication to the Mayor and members of the Board of Estimate and Apportionment, in which the Board of Estimate and Apportionment was requested to advise him officially whether or not the proposed instrument met with its approval, and whether or not there were any criticisms, suggestions or amendments which it desired to offer in furtherance of and to safeguard the city's interests, and stating further that "Because of the objections and suggestions made on behalf of the City of New York and called to the attention of the New York State Commission, the members of the Legislature of this State are unwilling to proceed with the proceedings involving the entry into such compact or treaty, or to create such Port Authority as proposed with or without power until the City of New York, through its elected officials, has made its position in relation to the same definitely known." The Board of Estimate and Apportionment held a public hearing on March 26th, 1919, at which the Commission and its counsel attended by direction of the Governor, and counsel for the Commission outlined the history and purpose of the proposed compact. On April 4th the Board of Estimate and Apportionment adopted a resolution in which it expressed itself as being "*impressed with the necessity for co-operation between the two States of New York and New Jersey to develop the Port of New York*" and "ready to immediately consider and carefully study any comprehensive plan having that for its object," but in which the Board expressed the belief that "the presentation and adoption of such comprehensive plan should precede the making of the Proposed Treaty granting such vast powers for all time to the Port Authority in the Port District to be created thereby." The Board, however, recommended that the Port and Harbor Commission be continued in existence; that the Legislatures of both States make the necessary appropriations to enable it to complete its work, and stated further that "the active and earnest co-operation of New Jersey in any movement tending to improve and develop the Port of New York in all its parts and to the fullest extent" is invited by the Board. Following this resolution, the Legislative Bi-State Conference met on April 5th and unanimously adopted resolutions expressing its view that the Port and Harbor Development Commission should continue its work; that each State make the necessary appropriation therefor; that the Legislatures of each State continue the present Bi-State Legislative Commission; that "pending the consummation of such compact and the working out of a comprehensive plan for the development of the Port, *all projects for terminal facilities within the Port of New York shall be submitted to the New York, New Jersey Port and Harbor Development Commission for consideration and advice*, to the end that so far as practicable all such projects shall be in harmony with such comprehensive plan when ultimately adopted." It further resolved that "to the end that a compact between the two States may be submitted to the next Legislature of each State, amended in the light of suggestions made and to be made, the present conference be continued and the legislative sub-committee of each State be instructed and directed to confer with the New York, New Jersey Port and Harbor Development Commission and its counsel and present at an adjourned meeting of this conference, to be held at such time as the sub-committee is ready to report, a revision of the present revised draft of the proposed compact between the States which shall take account of all suggestions that have thus far been made or may hereafter be made." Pursuant to this resolution the Legislative Bi-State Commission has taken up the revision of the proposed compact, and after many conferences is rapidly reaching an agreement upon the proposed draft.

The comprehensive physical plan, contemplated as the culmination of the work of the Bi-State Port and Harbor Development Commission, cannot be completed and reported for action, together with the statistical information or economic proof to support it, before the 1st of July next. The Bi-State Commission has so advised the Legislative Bi-State Conference, and has so advised the members of the Board of Estimate and Apportionment. By July 1st the Legislatures of both States will have adjourned and if the proposed compact is not submitted until the physical comprehensive plan is approved, it will not come before the Legislatures of 1920 in both States, but must wait for the Legislatures of 1921; and as the proposed compact will require for its full ratification the approval of Congress, the joint effort of the two States is likely to be postponed until late in 1922, even though the desirability of joint development is concurred in and a definite physical comprehensive plan satisfactory to all the communities within the Port District is adopted. The necessity for port improvement by the Port of New York, its relation to the high cost of living not only as it affects the matter of terminal markets, but in the burden that it imposes upon every piece of material that goes into the life of the community, is so great that the Commission believed and still believes that the compact should be considered by the Legislatures of the two States this year in such form as will make the power of any agency created by such compact dependent for execution upon the approval of the comprehensive physical plan.

In view of the importance of the matter to the City of New York, therefore, the Chairman of the Bi-State Port Commission addressed a letter on January 12th, 1920, bringing this situation to the attention of the Board of Estimate and Apportionment and requesting that, in order that the draftsmen of the proposed compact might have the benefit of the criticisms, counsel and suggestions of the Board of Estimate and Apportionment, the Board reconsider its action of April 4th, 1919, and give to the Legislative Bi-State Commission the benefit of such counsel, criticism and suggestions.

This memorandum is submitted in response to the request of the Board of Estimate and Apportionment for a statement of the reasons why the resolution adopted by the Board of Estimate and Apportionment on April 4th, 1919, should be reconsidered and a statement of the reasons for the approval of the proposed revised treaty.

I

A year's time in port development is worth saving

If the two States are to join in a comprehensive development of the Port of New York, it is imperative that they should be permitted to do so at the earliest opportunity. They will not be able to do so without some kind of an agreement between them, approved by Congress. The port lies in two States. It is subject to the jurisdiction of three sovereignties — the State of New York, the State of New Jersey, and Congress, by virtue of its control over interstate commerce. Without some legal basis for co-operation, nothing can be done. While, therefore, the physical plans for the development of the port may properly take time for study, public discussion and ultimate approval, the legal basis for co-operation between the States should be established. If such a legal basis is to be established, it will require the action of the Legislatures of both States and approval by Congress. The Legislatures of both States are now in session, but will adjourn, so we are advised, early in March, or at latest the latter part of March. As the report of the Commission, together with the comprehensive physical plan and the reasons therefor, cannot be completed before the 1st of July, an entire year will be lost before the legal basis for co-operation can be established.

II

A compact between the two States can be effectuated which shall be conditioned upon the ultimate approval of the comprehensive physical plan

In all of the deliberations of the Legislative Bi-State Commission it was agreed that the Port Authority contemplated in the proposed compact as the agency for effectuating the joint purposes of the two States should not be permitted to function until the comprehensive physical plan had been approved by both States. Article VI of the proposed compact contains the following proviso: "The powers granted in this article shall not be exercised by the Port Authority until the Legislatures of both States shall have approved of a comprehensive plan for the development of the port as hereinafter provided" — but in order that the two States might not be precluded from vesting any power in the Port Authority, however desirable, the following provision was added: "Provided, however, that the Legislature of either State with the approval of the Legislature of the other State may from time to time authorize the Port Authority to proceed with specific matters." The theory of this qualification was that the comprehensive plan, when presented, might secure the general approval of all the communities of its backbone or general plan, and yet require modification as to details, and in order that there might not be any delay in laying the foundations for a real Port of New York, the power to proceed with specific matters was reserved.

If this reservation of power (which the Legislatures of both States now have) is deemed unwise, the proviso can be eliminated and the entire operation of the Port Authority conditioned upon the approval of the comprehensive plan.

III

Opportunity for co-operation between the two States may be lost if the compact is not approved now

On April 5th, 1919, when New York requested a year's adjournment of the matter for further consideration, Senator Case, now Acting Governor of the State of New Jersey, then majority leader and chairman of the New Jersey delegation to the Legislative Bi-State Commission, said that while New Jersey "will, of course, be as patient as its interests will permit * * * we cannot agree to an indefinite continuance of our deliberations." "* * * we have reached the point across the river where several communities are actively demanding a plan or program of some character. Our problem is that we have in our State, and on our waterfront, the terminals of the great continental railroads; and at the present time we are not reaping the benefit from them that we may reap, and cities like Newark, Jersey City and others, are demanding a State program. We have been holding them back, saying, 'Here is a great comprehensive plan for the greatest port in the world, and we will be part of it,' and that is satisfying them, and they are being satisfied, but of course we cannot keep on saying that too long * * * we are favorable to the plan before us to-day, and * * * respectfully urge that any delay in the consideration of it be shortened to the greatest possible degree." At the same time Governor Edge, now United States Senator from New Jersey, said: "I am very sorry it seems this — whether it is an impossible barrier, of course, I know not — has arisen * * * but I may say very positively for New Jersey, with great regret, if we cannot enter into the marriage ceremony, I shall certainly recommend, and I feel that we have the united support of our State Government, represented by both political parties; and the Commission already in existence in New Jersey, with all the authority we could give them on the Jersey side, will proceed so far as it is possible to proceed, to harness the possibilities of the great port of New York on the Jersey side." The statements made by Governors Edge and Case at that time have since been confirmed in the renewed activities for development on the New Jersey side of the port. The recent announcement that the Cunard Steamship Co. has arranged to spend $30,000,000 for eight concrete and steel wharves a thousand feet long at Weehawken further emphasizes the necessity for prompt agreement upon general policy between the two States. Since the contest between New York and New Jersey in the *New York Harbor Case*, in which New Jersey petitioned for a separate rate zone from that of New York, there have been amity and good feeling between the two States. That amity and good feeling have been carried forward in the cordial relations between the members of the Commissions from both States, the Port and Harbor Development Commission, as well as the Legislative Bi-State Commission. This amity and good feeling should be cemented and confirmed by solemn pledges of co-operation and by provision for the method of co-operation. Each State is entitled to know the intention of the other and not to be held in abeyance by loose assurances of ultimate co-operation. If the present Port and Harbor Development Commission goes out of existence, leaving a report and a plan, however well considered, however far-sighted in its outlook, with no agreement between the two States to go forward and no agency through which they may co-operate, the present pleasant relations between the two States can easily be changed and the old spirit of rivalry and jealousy revived. During the discussion of the *New York Harbor Case*, criticism was made of New Jersey's attitude upon the ground that she was seeking to "split the Port of New York." For two years now New Jersey has been co-operating with New York in an effort to bind the port together. If this effort, made in good faith, should be repulsed or discouraged in any way, New Jersey will feel that she is not to blame. Delay in the consummation of the legal basis for co-operation between the States is dangerous.

IV

Co-operation between the two States is essential

The Port of New York is viewed with envious eyes by its competitor ports. Within the past few years great changes have taken place in the routes for transshipment of freight. Even greater changes will take place. The projected deepening of the St. Lawrence River is being pressed for by the rest of the country, because it is believed that it will make the Lake ports accessible to ocean-borne commerce. The recent improvements to the Mississippi route from Chicago to New Orleans is likely to send more freight from the Central West out of the port of New Orleans. The existing differential in favor of Philadelphia and Baltimore already has injured the commerce of the Port of New York. This is no time for division between the east and the west side of the port. It is a time for harmony and for co-operation. But until the two States have come to an understanding in definite legal form, each has the right to assert its rival claims and advantages in securing business, Federal appropriations and any other benefits it may, by its energy, initiative and enterprise, obtain. Once the parties agree upon the terms of their co-operation they will be partners instead of rivals, and can join hands in the great work of reconstructing the port.

V

The proposed compact and the reasons therefor briefly stated .

(A) *What it does.* The proposed compact, after the recitals (p. 3, lines 1 to 20; p. 4, lines 1 to 3) of the importance of the commerce of the port, recognition of the existing fact that "the territory in and around the port has become commercially one center or district" and that "a better co-ordination of the terminal, transportation and other facilities of commerce in, about and through the Port of New York, will result in great economies, benefiting the Nation, as well as the States of New York and New Jersey," and that this development "will require the expenditure of large sums of money, and the cordial co-operation of the States of New York and New Jersey in the encouragement of the investment of capital, and in the formulation and execution of the necessary physical plans," and that such a result can best be accomplished through the co-operation of the two States by and through a joint or common agency, by Article I (lines 7 to 10, p. 4) pledges each State to "faithful co-operation in the future planning and development of the port," and by Article II creates a district to be known as the "Port of New York District." By Article III there is created "The Port of New York Authority," a public corporate body with the powers and jurisdiction enumerated in the proposed compact and such other and additional powers as shall be conferred upon it by the Legislature of either State, concurred in by the Legislature of the other, or by act or acts of Congress. By Article IV it is provided that the Port Authority shall consist of six commissioners, three resident voters from the State of New York, two of whom must be resident voters of the City of New York, and three resident voters from the State of New Jersey, two of whom shall be resident voters within the New Jersey portion of the district, the New York members to be chosen by the State of New York and the New Jersey members by the State of New Jersey, in the manner and for the terms fixed by the Legislature of each State respectively. Under Article VI the Port Authority is given full power and authority to purchase, construct, lease and/or operate any terminal or transportation facility within the district, to own and hold real and personal property, to borrow money and secure the same by bonds or mortgages *on any property held or to be held by it.* It is expressly provided that none of the property of either State or of any county, city, borough, township or municipality shall be taken by the Port Authority without the authority or consent of such State, county, borough, township or municipality; and it is expressly provided that the Port Treaty shall not affect the bonded indebtedness of any community, nor impair the provisions of law regulating the control of the revenues derived from municipal property. The same article provides that the Port Authority, as has already been indicated (see Point II) shall not exercise any of its powers "until the Legislatures of both States shall have approved of a comprehensive plan for the development of the port as hereinafter provided" — the present qualifying provision being only "that the Legislature of either State with the approval of the Legislature of the other State may from time to time authorize the Port Authority to proceed with specific matters." By Article VII the Port Authority is precluded from pledging the credit of either State, except by and with the authority of the Legislature thereof. By Article VIII the jurisdiction of the public service commission or the public utility commission, or like body, within each State, over railroads, transportation, terminal and other facilities is preserved, even if such railroad, transportation or terminal facility is owned or operated by the Port Authority. Article IX provides that the Legislatures of the two States "will adopt a plan or plans for the comprehensive development of the port of New York" either prior to the signing of the compact, or thereafter, as soon as may be practicable, and further, that "no modification in such plans shall be made except by the Port Authority with the approval of the municipality or municipalities directly affected by such modifications." By Article XIV the pledge of each State to the support of the Port Authority is limited to $100,000. By Article XV it is provided that no action of the Port Authority "shall be binding unless taken at a meeting at which at least two members from each State are present and unless four votes are cast therefor, two from each State." Article XV further provides that "Each State reserves the right hereafter to provide by law for the exercise of a veto power by the Governor thereof over any action of any commissioner appointed therefrom." Article XVII provides that the Port Authority may, when concurred in or authorized by the Legislatures of both States, make suitable rules or regulations, not inconsistent with the Constitution of the United States or of either State and subject to the power of Congress over interstate commerce.

(B) *Limitations upon the Port Authority.* From the foregoing summary it will be clear that the Port Authority cannot take over the property of any municipality without its consent, and that the franchise-granting power and the control over the streets of any city remain intact. THE PORT AUTHORITY, THEREFORE, IS NOT A SUPERVENING AGENCY, BUT IS AN AGENCY FOR CO-OPERATION OF ALL THE MUNICIPALITIES WITHIN THE DISTRICT IN BOTH STATES. Unlike the Port Authority at London, at Liverpool, at Montreal, or at New Orleans, it derives its greatest power not through the taking away of the initiative and independence of the various municipalities within the district, but through its capacity to aid those municipalities in working towards a comprehensive organization of the port which will be of advantage to all.

(C) *The borrowing capacity of the Port Authority.* Public attention has already been drawn to the fact that neither State, nor any city within the Port District, is legally constituted to borrow the vast sums of money necessary for a comprehensive scheme of port development. Assuming that port facilities within the port are self-supporting enterprises, returning large profits and amortizing themselves within a reasonable period, without the creation of an agency of this kind, the self-supporting character of the enterprise will not exempt it from the debt limit until the fact is demonstrated by actual operation. The Port Authority may, however, upon the merits of any given development, float its own bonds, backed by the assurance that it is a part of the great development of the port. The Port Authority can become the co-operative agency of any municipality, which, conditioning its grant of privileges upon the ultimate vesting of title to the property in the municipality, may hasten its own development through the assistance of the Port Authority.

(D) *There is no limitation upon the freedom or initiative of any municipality in the proposed compact.* Provided any development is in conformity with the comprehensive plan, the municipality may go forward, as, indeed, may any private enterprise, to the full extent of its capacity. The limitations upon municipal and private activity, therefore, will come in the comprehensive plan. This plan will have to receive the approval of both States and the Legislature of the State of New York has already indicated that the City of New York will not only be consulted, but will practically have the final say as to the approval of the plan. Such a plan will have to justify itself economically; that is to say, it will have to be supported by proof of the economies and savings that may be derived through its operation. It must be so laid out that all the communities within the Port District shall be willing to join hands in working towards its realization.

VI

The Port of New York is one port

The Interstate Commerce Commission held, upon the argument of the State of New York, that "Historically, geographically and commercially New York and the industrial districts in the northern part of the State of New Jersey constitute a single community." This is the legal basis for maintaining the present rate zone.

VII

The problem of terminal markets is dependent upon a solution of the larger terminal problem

The terminal markets within New York State cannot be located without relation to the belt lines now in New Jersey. New York City normally consumes daily 1,800,000 quarts of milk, ninety-four carloads of refrigerated meats, seventy-four of livestock, eighteen of live poultry, twenty of fresh fish, 127 of dairy products, 201 of vegetables and 107 of fruit. During the harbor strike of 1918 the Port and Harbor Development Commission investigated the movement of food and found that the New York railroads, exclusive of diversions, brought 30.652 per cent. and the New Jersey 43.358 of the milk. For refrigerated meats the corresponding percentages were 35.106 and 19.503; for livestock 78.378 and 29.730; for live poultry 0.000 and 5.555; for fresh fish 60.000 and 6.666; for dairy products 14.173 and 8.792; for vegetables 22.093 and 14.203; for fruit 17.757 and 9.346. All agencies agree that "The present facilities for receiving rail and water shipments of foodstuffs in New York City have grown up in a haphazard way without much relation to the needs of the enormously increased population of the city or the changing character of the city itself." (Governor Smith's Reconstruction Commission Report, June 14, 1919.) "Improved terminal facilities would not only reduce the ultimate cost of food to the consumer, but would permit dealers to do business more economically and would provide them with facilities for doing a much larger business." (Governor Whitman's Market Commission.)

VIII

The need for increasing facilities to take care of the new international business that is coming

In its survey of port facilities the United States Shipping Board says that American port facilities are "taxed to capacity by the present shipping — in many instances overtaxed, and in nearly all instances, unless they are speedily expanded, facing serious congestion. This is especially true of the facilities of New York Harbor, the greatest problem of port development in the world to-day." In its public announcement of August 4th, 1918, the United States Shipping Board said: "A doubling, and perhaps trebling, of docks, piers, marine railways, and terminal facilities in general of Atlantic, Gulf, and Pacific ports will probably be called for by the swiftly increasing American merchant marine." And on March 30th, 1918, United States Interstate Commerce Commissioner James S. Harlan, in his report to the Director-General of Railroads, said, referring to the Port of New York: "Wholly aside from the extraordinary volume of the traffic, to and through the port, of the allied and of our own military and naval establishments at this time, new and enlarged terminal facilities must be provided, apparently on a liberal scale and on both sides of the river, if the port of New York is to hold its commanding place in our domestic and foreign commerce." Recent utterances by Collector Byron D. Newton confirm these statements.

IX

The selection of commissioners

The compact leaves to each State the method for naming the commissioners, except that in the case of New York at least two of the three commissioners must be resident voters of the City of New York and in the case of New Jersey they must be resident voters within the New Jersey section of the Port District. The method of selecting the commissioners for the State of New York is properly the subject for discussion between the members of the Legislative Bi-State Commission from New York and the representatives of the City of New York. The Port and Harbor Development Commission believes that this is not a matter that should be part of the negotiations between New York and New Jersey. It is intrastate and not interstate. It believes, also, that the public policy of the State with regard to the method of selecting the membership of the Port Authority may be subject to revision from time to time, and that the State should not be limited by the restrictions of the treaty. But as this is one of the matters upon which the counsel, advice and suggestions of the present officials from New York are solicited, the Commission will give earnest consideration to any suggestion coming from the Board of Estimate and Apportionment upon this subject, so that in formulating its recommendations to the Legislature it may know the opinion of the Board of Estimate and Apportionment of the City of New York.

X

The comprehensive physical plan

This cannot be completed by the Bi-State Port Commission until it has gone through the process of analyzing costs and is prepared to recommend a plan that is justified upon the basis of economic proof; but after the Commission has approved of it, it must then be submitted for public discussion. The Commission is convinced that at least six months should be allowed for study by all of the municipalities concerned in the plan before it is presented to the Legislatures for their consideration, and that the Legislatures may properly provide at this session for the method of procedure by which the plan may be publicly considered. In the meantime, however, the Commission believes that the compact can be approved and on its way to ratification by Congress.

All of which is respectfully submitted.

January 23, 1920.

New York, New Jersey Port and Harbor
Development Commission,
William R. Willcox, Chairman,
J. Spencer Smith, Vice-Chairman,
William Leary, Secretary.

Julius Henry Cohen,
Counsel.

APPENDIX I

Act (N. Y.) to Authorize Appointment of Port Authority Commissioners Introduced in 1920 Legislature

AN ACT to authorize the appointment of commissioners to "The Port Authority" established by the agreement or compact between the states of New York and New Jersey within the "Port of New York District."

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. The governor shall, by and with the advice and consent of the senate, appoint three commissioners to the port authority created by the agreement or compact between the states of New York and New Jersey entered into or about to be entered into under laws passed by the states of New York and New Jersey authorizing such agreement or compact.

§ 2. At least two of said commissioners shall be resident voters of the city of New York and recommended by the municipality of the city of New York as hereinafter provided.

§ 3. The board of estimate and apportionment of the city of New York shall by majority vote recommend to the governor for the purposes of such appointment a list of five candidates. The governor shall call upon the board of estimate and apportionment to recommend such a list to him and such list shall be furnished to the governor within twenty days after he has called therefor.

§ 4. In the event of the failure or default of said board of estimate and apportionment to furnish the governor within the time specified with such list of recommendations, then the governor by and with the advice and consent of the senate shall make his appointments without such recommendations.

§ 5. The three commissioners shall not be appointed by the governor until and after the said agreement or compact shall have been executed on behalf of the two states of New York and New Jersey by the designated authorities authorized to execute the same.

§ 6. The commissioners when appointed shall hold office until the first day of July, nineteen hundred and twenty-two. They shall have the powers and duties and be subject to the limitations provided for in the compact or agreement entered into between the two states.

§ 7. In the event of any vacancy occurring in the office of the commissioners prior to July first, nineteen hundred and twenty-two, by reason of death, resignation or otherwise, the governor shall, by and with the advice and consent of the senate, fill such vacancy, and if the vacancy occur in the case of a commissioner recommended by the board of estimate and apportionment of the city of New York, before making such appointment the governor shall call upon said board of estimate and apportionment for a list of three names of candidates recommended for the office and the board of estimate and apportionment shall furnish such list within twenty days after so requested by the governor, and in the event of the failure or default of the board of estimate and apportionment to furnish the governor with such list of recommendations within the time specified, then the governor, by and with the advice and consent of the senate, shall make such appointment without such recommendations.

§ 8. This act shall take effect immediately.

APPENDIX J

Act (N. J.) Authorizing Appointment of Port Authority Commissioners Introduced in Legislature of New Jersey. Passed by Senate April 12, 1920, and by Assembly April 15, 1920

AN ACT to authorize the appointment of commissioners to "The Port Authority" established by the agreement or compact between the States of New York and New Jersey within the "Port of New York District."

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey:*

1. The Governor shall, by and with the advice and consent of the Senate, appoint three commissioners to "The Port Authority" created by the agreement or compact between the States of New York and New Jersey, entered into or about to be entered into under laws passed by the States of New York and New Jersey authorizing such agreement or compact.

2. At least two of said commissioners shall be resident voters within the New Jersey portion of the "Port of New York District" as described in and bounded in said agreement or compact.

3. The three commissioners shall not be appointed by the Governor until and after the said agreement or compact shall have been executed on behalf of the States of New Jersey and New York by the designated authorities authorized to execute the same.

4. The commissioners when appointed shall hold office until the first day of July, nineteen hundred and twenty-two. They shall have the powers and duties and be subject to the limitations provided for in the compact or agreement entered into between the two States.

5. In the event of any vacancy occurring in the office of the commissioners prior to July first, nineteen hundred and twenty-two, by reason of death, resignation or otherwise, the Governor shall fill such vacancy.

6. This act shall take effect immediately.

APPENDIX K

Memorandum Filed by the Board of Estimate and Apportionment before the Judiciary Committee of the New York Senate on the 20th Day of April, 1920

The act creating the joint commission to investigate and report upon conditions in the Port of New York and recommend a policy with respect thereto, to be carried into effect "by legislative enactment or treaty or otherwise," has not been complied with by the joint commission, which now seeks the creation of a new commission with unlimited powers that shall hereafter determine such Port policy and the manner and time in which it may be carried out in whole or in part, according to its unrestrained discretion.

Requirement of Act of 1917

A commission was created by Chapter 426 of the Laws of 1917 entitled

> "An Act to establish a commission to act jointly with a similar Commission of the State of New Jersey in the investigation of Port conditions at the Port of New York and to submit a comprehensive report recommending the proper policy that shall be pursued for the best interests of the entire Port of New York, and the legislation, State and Federal, that will be necessary to make such recommendations effective and making an appropriation for the expenses of said Commission."

The joint commission appointed under Chapter 426 of the Laws of 1917 has not yet performed the duty thereby imposed

> "to negotiate or agree upon a joint report recommending a policy to be pursued by the State of New Jersey, the State of New York and the United States by legislative enactment or treaty or otherwise, to the end that said Port shall be efficiently and constructively organized and furnished with modern methods of piers, rail and water and freight facilities, and adequately protected in the event of war."

Instead of performing that duty it is endeavoring to bring about the creation of another commission pursuant to the so-called Treaty, which commission from time to time hereafter shall determine such policy.

The act of 1917 required that

> "before making such a report such commission shall make a thorough study of Port conditions in this country,"

and it was required to take all necessary steps

> "for the effective working out of a comprehensive and adequate interstate and Federal Port policy to meet commercial needs in time of peace and the protection of the harbor and adjacent localities in times of war."

In a preliminary report dated January 26, 1918, upon the faith of which the commission received appropriations of $400,000 it recognized the purpose and necessity of complying with the Act creating it, as follows:

> "the Commission now makes its recommendations upon the necessity for a comprehensive joint report upon the Port Problem, the feasibility of making such a report at the present time, its desirable scope and the time and expense which would be involved in its preparation" (page 7).
>
> "The necessity for the establishment of a definite Port policy as well as a Port authority and of a comprehensive plan for the future is most graphically demonstrated by the present congestion of the commerce of the Port" (page 9).
>
> "The feasibility of making a comprehensive report upon the Port Problem at this time has been fully considered by the Commission" (page 10).
>
> "The Commission definitely recommends that the study contemplated in the legislation creating the Commission and outlined in this report be undertaken, the report prepared and to that end the two States of New York and New Jersey appropriate $400,000 in equal payments covering a period of two years" (pages 15, 16).

It is the very evident purpose of the Act of 1917 creating the Commission now proposing a Treaty with the State of New Jersey that the "comprehensive report recommending the proper policy that shall be pursued" "by legislative enactment or treaty or otherwise," is a report which sets forth every material fact with respect to the conditions in the Port of New York necessary to determine the method and plan according to which such Port should be developed, and having determined upon such method and plan to negotiate with the State of New Jersey to carry them into effect by Treaty or Legislative enactment.

Act of 1917 Has Not Been Complied With

The Commission has utterly failed to perform the duties imposed by the Act. It has not yet made such a report although it has had ample appropriations and more than the time requested in which to do so. It is now endeavoring to procure the enactment of a Treaty which would be binding for all time without the submission of any such report containing facts from which the necessity or purpose to be served by such a Treaty may be inferred.

The so-called Treaty is merely an attempt to finance private enterprises with public funds and to escape constitutional limitations upon public debt.

In its report, dated January 26, 1918, the Commission set forth that—

> "For the purpose of eliciting information and opinions, the Commission adopted a questionnaire upon the Port Problem (Appendix B) which was submitted to various railroad, shipping and warehouse interests affected and answers were secured giving their respective views upon the necessity of a comprehensive report and their opinions upon the details of such a report."

In its questionnaire, addressed to railroads and others, the Commission in question 24 inquired:

> "**24. Governmental Assistance in Financing Port Expansion.**
>
> "If a single Port authority is desirable, would you consider it feasible and advisable that a public trust take the place of the many present private ownerships of the waterfront, somewhat following the experience of London and Liverpool, thus relieving the railroads from securing the large amount of new capital necessary for expansion and the future development of the Port, which should be financed more cheaply by governmental ownership?"

No report has been made by the Commission disclosing the answers to these queries, but their purport is reflected in the principal preambles to the so-called Treaty, which read as follows:

> "Whereas, The future development of such terminal, transportation and other facilities of commerce will require the expenditure of large sums of money, and the cordial co-operation of the States of New York and New Jersey in the encouragement of the investment of capital, and in the formulation and execution of the necessary physical plans; and
>
> "Whereas, Such result can best be accomplished through the co-operation of the two States by and through a joint or common agency;"
>
> Therefore, the Treaty is proposed.

In reference to this characteristic feature of the Treaty, The Chamber of Commerce states:

> *"it supplies the instrumentality for raising money for substantial port improvements without infringing upon the city's constitutional debt limit."*
>
> (Letter of Alfred E. Marling, President, to Charles L. Craig, Comptroller of the City of New York, March 15, 1919.)

Co-operation with New Jersey limited to such purposes

While the blessings of co-operation between New York and New Jersey are pledged in Article I of the so-called Treaty, the practical operation of the principle of co-operation is flouted by the express provision that it

> "shall not include matters relating to harbor or river pollution." (Art. XXII.)

There is thus reserved to New Jersey the right to continue to pollute the waters of the harbors and rivers around New York with undiluted and unlimited sewage, and for its acid factories and oil refineries to pour forth without restraint the fumes and gases that are so highly objectionable and injurious to the citizens of New York.

In face of the admitted necessity for Reconstruction of State Government by the reduction and abolition of boards and commissions, a new and wholly independent commission or corporation with unlimited powers is proposed.

At a time when there is a general revulsion in the State of New York against the multiplicity of boards, bodies and commissions exercising the functions of government and active efforts are being made by reconstruction for their reduction and abolition, the so-called Treaty proposes the creation of still another Commission, perpetual in duration and freed from all responsibility and accountability to those over whose property, money, rights, and conduct they are given jurisdiction; except for the mere formality of making an annual report to the Legislature, which cannot be questioned when made. (Art. VII.)

The creation or incorporation of irresponsible commissions is contrary to the very fundamentals of our government. The highest responsibility and the greatest powers under democracy are to be exercised only by those who are elected by and directly responsible to the people; and the worst evils that have grown up in this country are those incident to the performance of governmental functions by boards and commissions not responsible to the electorate and who hold under appointments for indefinite or overlapping terms and therefore cannot be reached or held accountable by the Governor or other executive or elective officers to whom their appointments were originally due. Such commissions or corporations once created go on forever.

The City of New York has had ample experience with such bodies as the Bronx Parkway Commission, Public Service Commission, Board of Water Supply, Grade Crossing commissions, and other like bodies, who, under powers granted by the acts creating them, have imposed upon the City of New York expenditures and obligations vastly in excess of those contemplated upon their creation. The prompt and diligent prosecution of public works has been interfered with and the public burdened and inconvenienced without any redress whatever.

The commission or corporation proposed to be created by the so-called Treaty overshadows all others combined in the grant of powers made to it and in the absence of any restraint or control upon the exercise of such powers. As indicated by the preambles, questions and declaration of the Chamber of Commerce above quoted, and as revealed in every line of the so-called Treaty, its practical and exclusive purpose is to create a body having unlimited power to borrow money upon the faith of public property and credit. It affords a means to escape the Constitutional debt limit of the City of New York. But the very method by which this is to be done reveals the intention to pledge public property as security for the indebtedness which may be created without limit or restraint.

It is quite manifest that the creation of a Port authority or any other "body corporate and politic" is not necessary in order to borrow money in unlimited quantities. Any corporation, whether organized for railroad, industrial, manufacturing or other purposes, may borrow money to an unlimited extent. It is only because the irresponsible Port authority contemplates borrowing upon the faith of public property that it has any justification whatever for its creation and existence.

Article VI of the Treaty grants "full power and authority" * * * "to borrow money and secure the same by bonds or mortgages upon any property held or to be held by it."

The assertion that the creation of the Port authority is a harmless preliminary is wholly fallacious.

The alleged necessity for the immediate authorization of the so-called Treaty in advance of the report and recommendation required by the Act of 1917 creating the Commission, is that if such report and recommendation were made in advance of the execution of the Treaty that the facts required to be disclosed would be so startling to the New Jersey interests that they would refuse to enter into any agreement whatever.

As already pointed out, it is in direct violation of the Act creating the Commission, which contemplates a Treaty to carry into effect a plan agreed upon and fortified by every material fact that can be ascertained.

The so-called Treaty, however, provides that the powers granted shall not be exercised until the Legislatures of both States shall have approved of a comprehensive plan for the development of the Port (Art. VI), and that

> "no city within the Port district shall be bound by the comprehensive plan unless and until it has approved of the same" (Art. X).

It is argued from these and other provisions that the making of the Treaty would be entirely harmless because the Port authority could not effectually function unless and until its proposed comprehensive plans were approved. But this is fallacious in the highest degree. It is easily within the power of the Port authority to prepare "a comprehensive plan" that shall be so attractive and so promising in its provisions that no member of the Legislature or other public officer would hesitate for an instant to approve such a plan. The approval of such a plan is a very different thing from having a treaty or compact with the State of New Jersey providing the manner and time in which it shall be carried into effect. In other words, a highly attractive comprehensive plan upon which the consent of the Legislature or the local authorities of any city might be procured would mean nothing whatever in the way of obligation as to when the parts vitally affecting the City of New York would be carried into effect. This is a matter that would rest wholly within the discretion and control of the so-called Port authority and it might postpone the New York improvements for an indefinite period.

The effect, however, of procuring the approval of the Legislature and the City of New York to such a plan, would lay the foundation for borrowing unlimited sums upon the security of property of the City of New York. The very approval of such a plan by the City of New York would be tantamount to a dedication of its public property within the scope of the plan to the purposes and uses thereof.

It has been quite freely admitted in argument before the Board of Estimate and Apportionment that the Port authority may sell its bonds or other evidences of indebtedness secured by mortgage upon property within the City of New York and apply the whole of the proceeds of such bond sales to the development of property in the Hackensack meadows or other parts of the State of New Jersey.

It is contrary to the statutes of the State of New York, the Greater New York Charter, and the Dongan and Montgomery Charters, and other ancient grants of the City of New York, for it to alienate any part of its waterfront and lands and lands under water. Notwithstanding this, the so-called Treaty contemplates that the City of New York may consent that any such property shall be taken by the Port authority and subjected by it to the lien of mortgages to secure the bonds and other evidences of indebtedness that it may sell (Art. VI). The city's consent may very well be implied from its approval of any "comprehensive plan" that may hereafter be prepared by the Port authority. There is no provision in the Treaty by which the City of New York could revoke or rescind any approval or consent that it might ever give.

The contemplated use of valuable and improved waterfront and terminal property of and within the City of New York, the ingenious avoidance of the constitutional debt limit of the City of New York, and the application of the proceeds of mortgages upon such property within the City of New York to develop railroad and other facilities and unimproved land in the State of New Jersey, according to the uncontrolled discretion of a commission hereafter to be appointed and a plan hereafter to be adopted, are the characteristic features and afford an ample explanation of the purposes of the so-called treaty.

It has been admitted upon the argument that overambitious enterprises in the State of New Jersey, to be financed by the money borrowed upon the security of New York property, may result in the foreclosure of such mortgages and the total loss of such property to the City of New York unless it is prepared upon the foreclosure sale to bid the face amount of principal and accrued interest upon the bonds secured by such mortgages.

The treaty evidently contemplates that the port authority shall also use the credit of the State of New York or the State of New Jersey, or both, but this cannot be done until a later stage when the communities are so far involved in the undertakings of the Port authority that the Legislature may be impelled to consent to the pledging of the State's credit.

It is to be observed, moreover, that the Port authority is not required to account to the City or State of New York, or to anyone, for the avails of the bonds or other securities that it may issue or mortgages that it may make. Such sums may be expended in any manner that the Port authority deems fit. There is not even any provision of law by which their contracts are required to be let at public bidding. There is no provision whatever that the surplus profits or other accumulations that may be amassed from time to time shall ever be distributed or divided or in any way apportioned to the State and the City of New York. In other words, perpetual accumulations and other profits or the avails of borrowing may go on without limit or restraint and subject only to such use as the unbridled discretion of the Port authority may dictate.

City of New York left without effective representation in the Port Authority

In conferences at which were present the Governor, members of the Board of Estimate and Apportionment, and of the New York, New Jersey Port and Harbor Development Commission, it was conceded that any so-called Port authority should include in its representation the elective officers of the City of New York. It was pointed out by counsel for the Commission that as the Port district included territory outside of the city, it would not be possible to name the Mayor, Comptroller and President of the Board of Aldermen as members of the Commission as one of such members would have to be from outside the City of New York. Such a provision would have evidenced an intention to fix responsibility at all times upon the duly constituted authorities of the City of New York for any action that might be taken with respect to property or facilities within the City of New York. The intention to eliminate any such responsibility is clearly indicated by the method for the appointment of Commissioners in the pending bill (S-Int. 1375, Pr. 1603). By that bill the Board of Estimate and Apportionment may recommend to the Governor five names from which he may select two. Such Commissioners, when appointed, are freed from any responsibility or accountability to the people of the City of New York. Moreover, it is to be observed that these provisions relate merely to the Commissioners that are to hold office until July 1, 1922 (Sec. 6). The Commissioners to be appointed after that date will be appointed under such legislation as may hereafter be enacted. No salary is provided for these Commissioners, who are expected to render their services gratuitously, like members of the present Board of Education in the City of New York.

The power of nomination is a wholly distinct and different thing from representation itself and is of little value. If it had been intended to protect the City of New York by having its elective officers at all times members of such Commission, it would have been a simple matter so to express such intention and to provide that section 1549 of the Greater New York Charter, which prohibits the acceptance of the appointment to any other office by such officers, would be inapplicable, as has been done in other legislation.

Private enterprises of financially responsible corporations not dependent upon so-called treaty

While the Commission proposing the so-called Treaty professes to be greatly concerned about the development of the Port of New York, and the New York members are said to be particularly apprehensive that New Jersey shall be restrained so as not to gain unfair advantage over New York, it is to be observed that large undertakings are going forward in New Jersey which the Commission does not pretend are in the slightest degree interfered with or restrained by any plan that it may have in contemplation. Such undertakings include nine new large modern piers by the Cunard Steamship Company, at Weehawken, New Jersey; a large dry dock enterprise on the New Jersey shore north of Weehawken and about opposite West 77th Street; and the filling in of the meadows by the

City of Newark by which Haynes Avenue is to be carried across from Newark Bay into the city. This will require approximately 400,000 cubic yards of fill and will prepare the way for the filling in of 200 or 300 acres of adjacent land.

The assertion often repeated in support of the so-called Treaty that it can do no harm because the new Commission cannot function until the approval of the so-called "comprehensive plan" hereafter to be produced is fallacious in a high degree. The passage of this legislation and the execution of this so-called Treaty establishes it to be the policy of the State of New York that it should proceed in the matter, although blindly, and commits the State definitely to the scheme. The next legislature will be confronted by the acts of its predecessors and it will be assuming too much to suppose that it would have the temerity to arrest an undertaking that has already received such legislative sanction. This is the time-worn device of committing the public authorities in advance of ascertained facts and definite conclusions so that those who succeed them in office will have no recourse but to proceed.

The Joint Commission should be required to submit the report and proposed agreement contemplated by the Act of 1917, indicating the manner and the method by which the Port of New York should be developed, thus establishing the policy of such port development, such agreement to contain the necessary assurances that the improvements therein provided shall be duly and properly provided in those parts of the Port affecting the City of New York; such agreement to be carried into effect by legislative enactment or treaty or otherwise by the States of New York and New Jersey and the United States. In default of the timely presentation of such report the Joint Commission should be abolished.

CITY OF NEW YORK,

BOARD OF ESTIMATE AND APPORTIONMENT.

Resolved, By the Board of Estimate and Apportionment of the City of New York, that the foregoing memorandum, in opposition to the measures referred to therein, be printed and transmitted to the members of the State Legislature. (Adopted April 16, 1920, Cal. No. 204-B.)

APPENDIX L

Legislation Establishing the Commission

Laws of 1917 of the State of New York

CHAPTER 426

AN ACT to establish a commission to act jointly with a similar Commission of the State of New Jersey in the investigation of Port conditions at the Port of New York and to submit a comprehensive report recommending the proper policy that shall be pursued for the best interests of the entire Port of New York, and the legislation, State and Federal, that will be necessary to make such recommendations effective, and making an appropriation for the expenses of said Commission.

Became a law May 8, 1917, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Commission created: duties.

Section 1. The Governor shall appoint three Commissioners who shall have power on the part of the State of New York to meet Commissioners appointed, or who may be appointed, under or by virtue of a law of the Legislature of the State of New Jersey[, to negotiate or agree upon a joint report, recommending a policy to be pursued by the State of New York, the state of New Jersey and the United States by legislative enactment or treaty or otherwise, to the end that said Port shall be efficiently and constructively organized and furnished with modern methods of piers, rail and water and freight facilities and adequately protected in the event of war]. Before making such report, such Commission shall make a thorough investigation of Port conditions in this country and shall take and employ such engineering, legal or other professional skill and assistance as it may need for the effective working out of a comprehensive and adequate interstate and Federal Port policy, to meet commercial needs in times of peace and the protection of the harbor and adjacent localities in times of war.

Expenses; no compensation.

Chairman and employees.

Appropriation.

§ 2. The Commissioners appointed pursuant to the provisions of this act shall be paid the necessary expenses incurred in the performance of their duties, but shall serve without compensation. They shall select one of their number as Chairman and may employ a Secretary and such other assistants as are needed in the performance of their duties. The sum of twenty-five thousand dollars ($25,000), or so much thereof as may be necessary, shall be hereby appropriated out of any moneys in the State treasury not otherwise appropriated, for the expenses of the Commission. The moneys hereby appropriated shall be paid out by the State treasurer on the warrant of the comptroller upon vouchers audited by the Chairman of the said Commission.

§ 3. This act shall take effect immediately.

Laws of 1917 of the State of New Jersey

CHAPTER 130

AN ACT. to establish a Commission to act jointly with a similar Commission of the State of New York in the investigation of Port conditions at the Port of New York, and to submit a comprehensive report recommending the proper policy that shall be pursued for the best interests of the entire Port of New York; and the legislation, State and Federal, that will be necessary to make such recommendations effective; and making an appropriation for the expenses of said Commission.

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey:*

Commission to investigate port conditions.

1. The Governor shall appoint three Commissioners who shall have power on the part of the State of New Jersey to meet commissioners appointed, or who may be appointed, under or by virtue of a law of the Legislature of the State of New York, to negotiate or agree upon a joint report recommending a policy to be pursued by the State of New Jersey, the State of New York and the United States by legislative enactment or treaty or otherwise, to the end that said Port shall be efficiently and constructively organized and furnished with modern methods of piers, rail and water and freight facilities, and adequately protected in the event of war. Before making such report such Commission shall make a thorough study of Port conditions in this country, and shall take and employ such engineering, legal or other professional skill and assistance as it may need for the effective working out of a comprehensive and adequate interstate and Federal Port policy, to meet commercial needs in times of peace and the protection of the harbor and adjacent localities in times of war.

Duties.

Expenses met.

Officers and assistants.

Appropriations.

2. The commissioners appointed pursuant to the provisions of this act shall be paid the necessary expenses incurred in the performance of their duties, but shall serve without compensation. They shall select one of their number as Chairman, and may employ a Secretary and such other assistants as are needed in the performance of their duties. The sum of seven thousand five hundred dollars ($7,500), or so much thereof as may be necessary, is hereby appropriated out of any moneys in the State treasury not otherwise appropriated, when included in any supplemental appropriation bill; and the sum of ten thousand dollars ($10,000), or so much thereof as may be necessary, is hereby appropriated out of any moneys in the State treasury not otherwise appropriated, when included in any annual appropriation bill, for the expenses of the Commission. The moneys hereby appropriated shall be paid out by the State Treasurer upon warrant of the Comptroller, upon vouchers signed by the Chairman of the said Commission.

3. This act shall take effect immediately.

Approved March 26, 1917.

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VOLUME II

PART IV

— Outline Summary of the Comprehensive Plan for the Future Development of the Port.

2 — Railroads That Serve the Port District — Locations of Main Lines, Branches, Break-up Yards, Waterfront Yards and Principal Ferry Routes.

— Grain Elevators, Electric Power Stations, Coaling Sta-
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General Arrangement of Tracks and Terminals in Man-
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s — Explained in Text, Pages 108–111, Volume I.

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Fig. 8 — Location in Manhattan of Line and Terminals Used for Detail Analysis of Initial Development of Automatic-Electric System.

Fig. 9 — Performance Record of Nine Ships in the Transoceanic Trade, Showing the Period Each Day Each Hatch Was Worked and the Reasons for the Large Amount of Idle Time.

Fig. 10 — One Day's Trucking to and from the New York Central's Pier and Inland Station South of Fifty-ninth Street — The Graph Shows the Excessive Length of Haul Under Present Conditions and the Possibilities of Great Saving in Trucking Distances Through Union Zone Terminals.

Fig. 11 — Principal Warehouses of the Port District — General Merchandise — Cold Storage — Other Food Products.

Fig. 12 — Present Layout of Piers and Bulkhead Structures on Manhattan's Hudson River Waterfront from the Battery to West Fifty-ninth Street, and the Layout Suggested by the Commission — Piers on Proposed Layout from Fulton Street to Perry Street are Those of the Newly Adopted City Plan — Feasibility of General Pier Dimensions and Bulkhead Structures Shown is Not Contingent in Any Way on Discontinuance of Ferries.

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